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Great Lakes and Ohio River Division

LOUISVILLE DISTRICT / HUNTINGTON DISTRICT / PITTSBURGH DISTRICT

Ohio River Main Stem Systems Study (ORMSS)

Ohio River Ecosystem Restoration Program

Integrated Decision Document and Environmental Assessment



Restore
and
Protect
the Ohio
River
Ecosystem



FINAL

October 2000



DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DIVISION, GREAT LAKES AND OHIO RIVER DIVISION
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Ohio River Ecosystem Restoration Program

ILLINOIS, INDIANA, KENTUCKY, OHIO, WEST VIRGINIA, PENNSYLVANIA

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OCTOBER 2000

NOTE: The draft Decision Document and Environmental Assessment for the Ohio River Ecosystem Restoration Program dated August 2000 contained information that was incorrect regarding in-kind credits. Under current Corps policy, no in-kind credit will be allowable under the Corps recommended Ecosystem Restoration program. Item 2 on page 5-1 and the in-kind credit description on pages 4-7 and 8-1 of the draft Decision Document and Environmental Assessment dated August 2000 has been deleted from this final report. The recommended plan contains no in-kind credits.

Syllabus

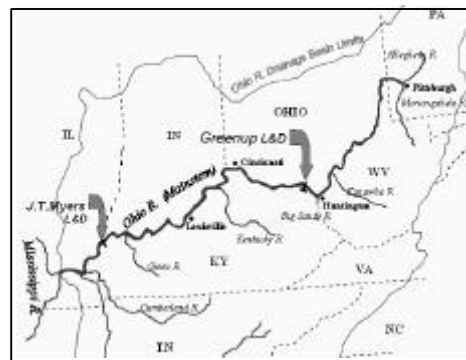
(Executive Summary)

This integrated Decision Document and Environmental Assessment is the second authorization recommendation document issued as part of the ongoing Ohio River Mainstem Systems Study (ORMSS). This report has been prepared by the Louisville, Pittsburgh and Huntington Districts of the Corps of Engineers with technical support from other Corps offices and the assistance of various other state and federal agencies.

The purpose of this ecosystem restoration program would be to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Ecosystem restoration efforts would involve a comprehensive examination of the problems contributing to the system degradation, and the development of alternative means for their solution. The intent of restoration would be to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system. The program will be initiated and monitored by a partnership of Federal and state resource agencies and regional environmental interest groups. As part of a Program Implementation Plan (PIP), this team will perform an initial ecosystem needs assessment and subsequent periodic updates of the assessment, along with monitoring to develop a recommended list of site-specific projects for implementation by the Corps of Engineers and non-Federal sponsors. These projects would aid in reestablishing many of the physical and dynamic processes necessary to more closely approach a natural, self-regulating ecosystem.

Ohio River Navigation

The mainstem of the Ohio River extends from Pittsburgh, Pennsylvania, to near Cairo, Illinois, where the Ohio joins the Mississippi River – providing 981 miles of commercially navigable channel. Year-round navigation is provided by a system of 20 locks and dams and annual maintenance dredging of the channels. During the late 1990's, approximately 240 million tons of bulk commodities were shipped on the Ohio River.



Problems and Needs

Human activities have influenced the ecological resources of the Ohio River and its floodplain for centuries. Over the last 200 years, forest harvest, agriculture, industrialization, urbanization, water pollution, mining, river impoundment, and a variety of other factors have affected environmental quality. Although, in recent years, much has been accomplished to improve water quality and lessen the impacts of human activities, many habitats remain in need of improvement for the benefit of a wide variety of species. Approximately 1,235,000 acres or 65 percent of the total forested floodplain was lost or converted to other uses between 1800 and 1970. Island acreage has decreased by 43 percent or 10,900 acres since 1900. These significant losses have reduced available habitat for fish and wildlife including Federally and state listed threatened and endangered species. In addition, river impoundment has greatly affected natural riffles and sandbars. As a result, aquatic habitat is limited for various species of freshwater mussels, fish, and other aquatic life.

Goals, Strategies, and Opportunities

As a part of the Ohio River Mainstem Systems Study (ORMSS), an environmental team consisting of personnel from the U.S. Fish and Wildlife Service, state natural resource agencies and the Corps of Engineers was formed to identify problems and establish goals, strategies and opportunities for an ecosystem restoration program. During the early study process, the interagency team founded the major goals of the program – the restoration and protection of wetland, terrestrial and aquatic habitats within the floodplain of the Ohio River. Within the context of those goals, the team then developed a number of strategies and opportunities to restore and preserve important ecological components within the Ohio River corridor. The opportunities for the proposed program are to: restore and protect 25,000 acres of bottomland hardwood forests, improve 1,250 acres of aquatic habitat, restore and protect 40 islands, improve 100 miles of shoreline/riparian habitat, and restore and protect 25,000 acres of wetlands.

After the goals and objectives were established, natural resource agencies of states bordering the Ohio River proposed various site-specific projects for implementation within the context of program problems and opportunities. Over 250 potential projects were proposed. Study reports of five example projects are provided within Appendix H of this document. These reports are included only to illustrate the variety of projects that may be implemented to accomplish the objectives of the program. It is important to note that further feasibility level study, resulting in a Project Implementation Report with appropriate analysis under the National Environmental Policy Act (NEPA) and other requirements (e.g., cost effectiveness and incremental cost analyses) will be required prior to approval of any projects for implementation. The Corps is, therefore, not seeking authorization of specific environmental projects; rather, the Corps is seeking authorization of the Ohio River Ecosystem Restoration Program, within which individual projects would subsequently be considered for implementation.

Existing ecosystem restoration authorities, such as Section 206 of the Water Resources Development Act (WRDA) of 1996 and Section 1135 of WRDA 1986, as amended, are essentially targeted towards specific environmental goals. Although some program objectives could be partially attained through those authorities, none (alone or in combination) provides a comprehensive approach for maintaining and improving a complex and extensive ecosystem such as the Ohio River corridor. A broader authorization, designated specifically for the Ohio River, would establish an over-arching program for restoration of its ecosystem. Such a program would allow restoration and protection of integral ecosystem components not generally included under existing program authorities.

Report Conclusions and Recommendations

The integrated Decision Document and Environmental Assessment provides the following conclusions and recommendations for authorization of an Ohio River Ecosystem Restoration Program:

- A comprehensive, managed ecosystem restoration program is needed for the Ohio River corridor consistent with current law and Corps policy.
- A recommendation for authorization of a 15-year program, with maximum Federal funding of \$10 million annually, for each of the first five years, and \$15 million annually for the remainder of the program.
- The creation of a partnership, composed of representatives from government resource agencies, universities, and other environmental concerns, for monitoring, evaluating and managing the Ohio River ecosystem.
- A corridor-wide ecosystem needs assessment and strategy, or Program Implementation Plan, would be developed initially to refine ecosystem goals and prioritize restoration efforts.
- Implementation of site-specific projects to accomplish program goals. Non-Federal sponsors would fund 35 percent of site-specific project first costs and 100% of operation, maintenance, repair, rehabilitation, and replacement.

FINAL

Integrated Decision Document and Environmental Assessment

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STUDY BACKGROUND

1.1 INTRODUCTION

The Ohio River stretches from Pittsburgh, Pennsylvania to Cairo, Illinois, for a distance of 981 miles. The river and its associated floodplain are a national treasure with a rich history of culture, commerce, and natural resources, many of which are declining and irreplaceable. Human activities have influenced the ecological resources of the Ohio River and its floodplain for centuries. Over the last 200 years, forest harvest, agriculture, industrialization, urbanization, water pollution, mining, river impoundment, and a variety of other factors have affected environmental quality. In recent years much has been accomplished to improve water quality and lessen the impacts of human activities, although many ecosystem components remain degraded. The needed improvements for the benefit of a wide variety of species, and the habitats they depend upon, are not being addressed through existing programs.

1.2 OHIO RIVER MAINSTEM STUDY OVERVIEW

The Ohio River Mainstem System Study (ORMSS) began as an overall, system-wide study to determine an optimum investment strategy for major navigation improvements along the entire length of the Ohio River. Over the course of the study, the need of and support for an ecosystem restoration program tailored to the unique characteristics of the Ohio River and its associated floodplain became a recurrent theme. Because of the apparent need for such a program, a component of the ORMSS became a study to determine whether an ecosystem restoration program specifically tailored to the Ohio River and associated floodplain corridor should be recommended for authorization. This study was conducted independent of navigation aspects of the ORMSS. This integrated Decision Document and Environmental Assessment is the second authorization recommendation document issued as part of the ongoing ORMSS. This report has been prepared by the Corps of Engineers Louisville, Pittsburgh, and Huntington Districts, with considerable technical support from other Corps offices, the U.S. Fish and Wildlife Service, and numerous other state and federal natural resource management agencies.

1.3 STUDY AUTHORITY

The authority for this ecosystem restoration study is the same as the basic authority for ORMSS and is contained in the resolution adopted by the Committee on Public Works of the United States Senate dated 16 May 1955:

Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby requested to review the reports on the Ohio River published in House Document No. 306, Seventy-fourth Congress, First Session, and related reports, with a view to determining whether any modifications in the present comprehensive plan for flood control and other purposes in the Ohio River basin is advisable at this time.

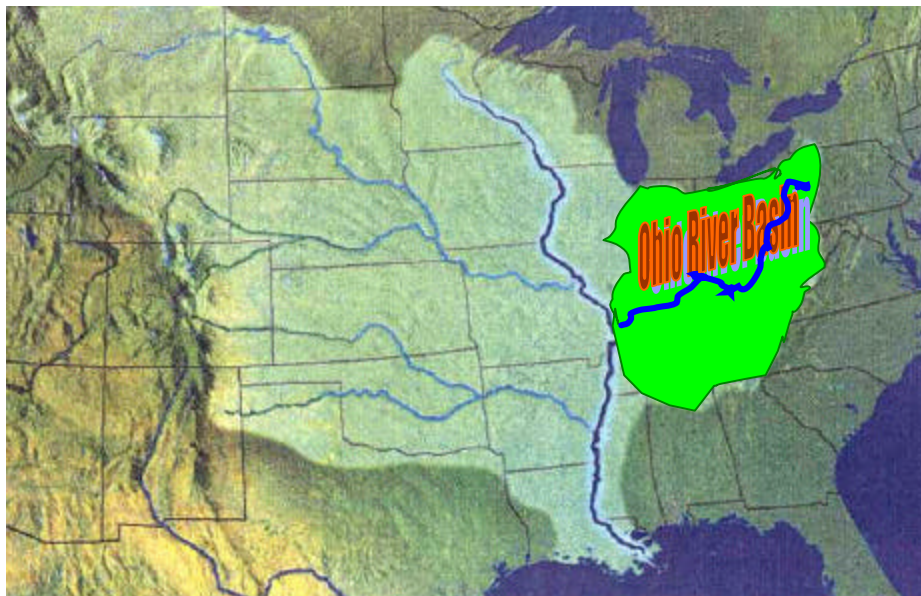
Further authority was provided through a resolution adopted by the U.S. House of Representatives Committee on Public Works and Transportation adopted 11 March 1992. This resolution reads as follows:

Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board for Rivers and Harbors established by the Section 3 of the River and Harbor Act approved June 13, 1902, is hereby requested to review the reports on the Ohio River published as House Document No. 492, 60th Congress, First Session and House Document 306, Seventy-fourth Congress, First Session, and other pertinent reports with a view to determine whether any modification in the authorized plan for modern barge navigation and other purposes on the Ohio River is advisable at this time with particular emphasis on need for improvements or replacement of Emsworth Locks and Dam, Ohio River Mile 6.1; Dashiels Locks and Dam, Ohio River Mile 13.3; Montgomery Island Locks and Dam, Ohio River Mile 31.7; and other locations where obsolete or inadequate facilities impede the orderly flow of commerce.

1.4 GEOGRAPHY OF THE STUDY REGION

The study area includes the main stem of the Ohio River, which extends from the confluence of the Allegheny and Monongahela Rivers at Pittsburgh, Pennsylvania, to near Cairo, Illinois, where the Ohio River flows into the Mississippi River. Year-round navigation is currently maintained on the entire 981-mile long mainstem by a system of 20 locks and dams (Figure 1). The 204,000 square-mile drainage area encompasses all or portions of fourteen states, including Alabama, Georgia, Kentucky,

Figure 1. The Ohio River Mainstem and the Locks & Dams



Ecological characteristics of the Ohio River are intrinsically linked to the topography and development of its drainage basin. Topography of the basin ranges from rugged mountains to flat plains. The Appalachian Mountains dominate the eastern portion of the basin. Most of this area is covered with hardwood forests with considerable areas of pastured hillsides. Extensive areas are disturbed by coal extraction and timber harvesting activities. Urbanization, agriculture, and industrial areas are mostly within or near floodplain areas. West of the mountains and south of the Ohio River, the landscape contains considerable local relief, which gradually modifies to rolling plains through most of Kentucky and Tennessee. This area is somewhat less densely forested than the mountainous area. Since the area is beyond the coal-fields, mineral extraction is not a primary feature of the landscape. Since relief is fairly moderate, agricultural uses are a major feature of the landscape. The moderate relief also allows a less constrained pattern of development, but urbanization and industrial area concentrations still tend to be linked to floodplains.

North and west of the Ohio River was mostly glaciated. The area now consists of broad plains with little relief extending from southwestern and central Ohio through central Indiana into southern Illinois. Agriculture dominates most areas not otherwise more highly developed. Development is generally not constrained by topographical features other than in flood prone areas. Instead, urbanized areas are distributed based on historic economic considerations, e.g., distance to markets.

1.5 PRIOR STUDIES

The Corps of Engineers has not completed any previous system wide studies for the Ohio River that focused on ecosystem restoration. Prior studies on ecosystem restoration have been site specific and associated with the Corps' Continuing Authorities including Section 1135 of the Water Resources Development Act (WRDA) of 1986, as amended, or Section 206 of WRDA 1996.

1.6 REPORTS

A comprehensive survey of navigation needs along the Ohio River was completed in 1969. However, that study did not include evaluation of the entire existing Ohio River ecosystem or ecosystem restoration projects. At the time of the study, ecosystem restoration was not a primary mission area for the Corps of Engineers.

1.7 EXISTING PROJECTS

The Louisville District has completed two Section 1135 Projects on the Ohio River. One project is located at Little Pitcher Lake near John T. Myers Lock and Dam. A second project is located at Evansville, Indiana. The Louisville District currently has a Section 1135 project under construction at McAlpine Lock and Dam in Louisville, Kentucky. Huntington and Pittsburgh Districts have not completed ecosystem restoration projects on the Ohio River. There are 20 locks and dams along the Ohio River. Also, there are numerous other Corps of Engineers projects constructed to provide local flood protection along the Ohio River.

1.8 EXISTING FEDERAL AND NONFEDERAL PROGRAMS

There are a number of existing programs available to address ecosystem restoration and conservation needs. A summary of some of the authorities that the Corps has to address ecosystem restoration are provided in Appendix I. Also information concerning other Federal programs are provided in the same appendix. The U.S Department of Agriculture has a number of programs that focus on conservation and ecosystem restoration. They have constructed numerous ecosystem restoration projects by working with private property owners.

There are also a number of non-government agencies and organizations that are actively involved in ecosystem restoration. Some excellent examples of these organizations include the Nature Conservancy, National Wildlife Federation, Ducks Unlimited, National Wild Turkey Federation, Sport Fishing Institute and many others. Both individually and collectively, their programs produce important ecosystem benefits. A comprehensive ecosystem restoration program for the Ohio River corridor would build on these accomplishments by undertaking improvement projects not being considered under existing programs, while still encouraging use of these programs for their intended purposes.

PURPOSE AND SCOPE

2.1 STUDY PURPOSE

The purpose of this study is to evaluate the need for an ecosystem restoration program specific to the Ohio River and its associated floodplain and, if needed, to develop the parameters of such a program to be recommended for authorization. The concept of seeking an ecosystem restoration program authorization was developed during the course of the Ohio River Mainstem System Study (ORMSS). Whereas the ORMSS will continue to evaluate long-term navigation needs along the mainstem Ohio River, this Decision Document/Environmental Assessment is the final report on ecosystem restoration under the ORMSS.

2.2 SCOPE OF STUDY

As part of the ORMSS, an interagency, multidisciplinary, environmental team was formed to participate in the planning and evaluation of navigation improvement strategies. This team was comprised of natural resources and regulatory experts from Pennsylvania, Ohio, West Virginia, Kentucky, Indiana, and Illinois, as well as representatives from the Corps of Engineers, U.S. Fish and Wildlife Service, and U.S. Environmental Protection Agency. As the environmental team coalesced, two recurrent themes developed: 1) the extent of ecosystem degradation that remained throughout the Ohio River corridor, despite the significant improvements to some resources over the past 30 years, and 2) the need for a program to deal with remaining current and future problems. Therefore, under the ORMSS authorities, the Corps of Engineers initiated the present study effort to evaluate whether an ecosystem restoration authority specific for the Ohio River is needed.

From the beginning of the study, the environmental team worked together to identify problems and important ecosystem restoration opportunities to benefit the Ohio River corridor. This report provides the results of those efforts and recommends authorization of an ecosystem restoration program for the Ohio River and its associated floodplains.

One of the team's first considerations was defining the area of study. The watershed of the Ohio River encompasses 203,910 square miles. Rather than trying to address the entire watershed, the team determined its focus should be on the river and

those resources most closely associated with, or most directly interacting with the river. Therefore, the area of study became the 981 mile long Ohio River corridor, which was defined as the mainstem river, tributaries influenced by the river, and the approximate 100-year floodplain. While the 100-year floodplain is defined for each reach of the river, the term “approximate” allows sufficient flexibility to look beyond the precise 100-year elevation as specific situations demand to ensure inclusion of integral ecosystem components.

The environmental team focused initially on ecosystem problems throughout the Ohio River and its associated floodplain. To explore resources in depth, the team organized into three working groups to focus on broad resource categories as follows:

- Aquatic problems,
- Terrestrial problems,
- Wetland problems

In addition, the entire environmental team examined institutional problems affecting ecosystem restoration efforts. They also examined the utility of existing authorities of federal, state, and non-governmental entities to accomplish ecosystem restoration throughout the river corridor.

Resource issues identified by the study team for evaluation included the following:

- Loss/Fragmentation of Riparian Corridors,
- Loss of Island Habitat,
- Conversion of Floodplain Habitats,
- Loss/Fragmentation of Bottomland Hardwood Forests,
- Loss of Wetlands,
- Deterioration of Backwater Habitats,
- Lack of Aquatic Vegetation,
- Loss of Sand and Gravel Bars,
- Threats to Tailwater Areas of Dams,
- Lack of Habitat Diversity in Pools,
- Deterioration of Side Channel/Back Channel Habitats, and
- Threats to Other Unique Habitats (e.g., canebreaks, bluffs, etc.).

Detailed information concerning the study process are in Appendix A. (Development of Program Goals, Opportunities, and Purpose).

2.3 COMPREHENSIVE NEED

Based on examination of issues and the inability of existing authorities to take a more holistic approach, the environmental team determined that a need existed for a

comprehensive ecosystem restoration program that acknowledges the uniqueness of the mainstem Ohio River Corridor and considers the river and its associated floodplain in an overall context. After over a century of environmental degradation, much has been accomplished towards restoring the river's resources through actions such as reduced pollutant discharges and increased emphasis on environmental protection in general. A comprehensive ecosystem restoration program for the Ohio River corridor would build on these accomplishments by undertaking improvement projects not being considered under existing programs, while still encouraging use of these programs for their intended purposes. The primary deficiency of relying on existing programs to accomplish ecosystem restoration goals is the lack of an over-arching strategic plan that focuses and prioritizes restoration efforts in a system-wide, interjurisdictional manner. The proposed program would undertake a comprehensive approach to restoring, improving, and protecting important ecological resources of the Ohio River corridor. Essential to the success of the program would be continued participation of the environmental partnership already formed among the six states and the Federal agencies, as well as the participation of other environmental interests along the river corridor.

DEVELOPMENT OF PROGRAM GOALS AND OPPORTUNITIES

3.1 HISTORY OF COORDINATION

Coordination with various Federal and State Resource Agencies has occurred on a regular basis since the beginning of the ORMSS. Since about 1997, interagency environmental team meetings have been held on a quarterly basis. The agencies and Corps Districts have worked together as a partnership in developing a plan for establishing a comprehensive ecosystem restoration program along the Ohio River. The visions and goals for this program and the identified opportunities were developed by three interagency working groups and approved by all representatives of Federal and State agencies participating in the study.

3.2 STUDY PARTICIPANTS

This feasibility study involved a core team consisting of Corps of Engineers staff from all three Districts of the Ohio River Basin and the following (see Appendix A for a complete list):

- U.S. Army Engineers,
- U.S. Fish & Wildlife Service,
- Ohio River Valley Water Sanitation Commission (ORSANCO),
- State Natural Resources Management agencies,
- State Historic Preservation Offices,
- Study Team Environmental Consultants, and
- American Rivers.

Over a year was spent in identifying the visions and goals of the partnership (see Appendix A for details). As described below, an extensive list of opportunities was developed to focus an ecosystem restoration program on key components of the

environment. In so doing, opportunities were not constrained so as to fit within existing authorities of any particular agency. The partners envisioned taking a comprehensive approach to solve a variety of problems along the Ohio River corridor.

3.3 DEVELOPMENT OF ECOSYSTEM RESTORATION GOALS

In the early stages of coordination, emphasis was focused on listing all the problems adversely impacting on the Ohio River. To the working groups it was obvious from the beginning that ecosystem needs were not limited to one aspect of the environment such as aquatic habitat. Therefore, program goals were established to include all aspects of the Ohio River ecosystem, irrespective of institutional constraints that would later come into consideration. The three working groups brought recommended goals to the environmental team for discussion. Following discussions, the environmental team agreed upon three broad goals as follows:

- Restore, enhance, and protect wetland habitats along the Ohio River corridor,
- Restore, enhance, and protect important terrestrial habitats adjacent to the Ohio River, and
- Restore, enhance, and protect aquatic habitats within the Ohio River.

3.4 DEVELOPMENT OF PROGRAM OPPORTUNITIES

The environmental team then developed categories for the resources and/or issues of greatest concern throughout the Ohio River corridor. These categories were:

- riparian corridors,
- islands,
- floodplains,
- bottomland hardwood forests,
- forested wetlands,
- scrub/shrub and emergent wetlands,
- backwaters,
- aquatic vegetation,
- sand and gravel bars,
- tailwaters,
- pools, and
- side channel/back channel habitats.

The team next sought to determine the extent of degradation of major habitat types. The following provides a summary of these determinations. Riparian corridors along the river are very fragmented, as compared to an almost continuous forested corridor that existed prior to settlement of the floodplain. Island acreage has decreased by 43% or 10,900 acres since 1900. Approximately 1,235,000 acres or 65% of forested floodplain has been converted to other habitat types since about 1800. Wetlands of all types have been extensively drained and/or filled. The substrate of the river changed as materials eroded from the floodplains and hillsides, which were stripped of their native vegetative covers. Backwater areas have become filled with silt since modernization of the navigation system began. Although, perhaps never a dominant habitat type in the river, today aquatic vegetation beds are scarce throughout the system. Most of the sand and gravel bars and riffle areas have been lost due to deepening of pools through impoundment and dredging for channel maintenance. Tailwaters now provide the last vestiges resembling free-flowing riverine habitat and are very important areas for fish spawning and supporting native mussel species. Pools are a predominant habitat type, but lack diversity or complexity compared to riverine reaches. Similarly, side and back channels lack habitat diversity. The team then developed goals for restoration of broad habitat types. These goals are to:

- restore 25,000 acres of bottomland hardwood forests,
- improve 1,250 acres of aquatic habitat,
- restore/protect 40 islands,
- improve 100 miles of shoreline/riparian habitat, and
- restore 25,000 acres of wetlands.

The goals were developed to address the most critical aspects of the river ecosystem. Additional detailed information regarding development of the program goals and opportunities are included in the Fish and Wildlife Coordination Act Report (Appendix D). Clearly, even full attainment of these goals would only begin to restore the Ohio River and floodplain to a more natural state. Therefore, the program would focus on those areas that would make the most meaningful contribution toward a self-sustaining, more natural environment. Considerations during development of the goals included:

- Need for creation of habitat benefits for a wide variety of species;
- Need for restoration of historic habitat types that are regionally extirpated, rare, threatened, or declining in abundance;
- Coordination with other conservation-based programs (e.g., North American Waterfowl Management Plan, Partners in Flight, etc.), and
- The degree of interest in cost sharing to accomplish the opportunities.

3.5 RESTORATION OPPORTUNITIES AND MEASURES

To address the problems identified, the partners in this endeavor attempted to further define needs in development of a comprehensive plan for ecosystem restoration along the Ohio River corridor. Starting off with the above broad list of goals, the team set out to develop the framework for a comprehensive program that could be built upon in the future. The following sections provide descriptions of opportunities and suggest measures to achieve these opportunities.

Under each opportunity, a list of tasks are provided to help describe what the partners would hope to accomplish within the context of a comprehensive approach to addressing the Ohio River ecosystem environment. Because of the huge scope of the problems and opportunities for the Ohio River, the following opportunities and descriptions of measures and tasks represent an initial step in development of a strategic plan to guide implementation of the program once authorized. The tasks or steps listed help describe what the partners desire to accomplish through an Ohio River Ecosystem Restoration Program. In some cases, participation by the Corps could be limited due to existing law or policy. However, the partnership could strive to find other avenues for implementing needed restoration in those cases.

Opportunity 1: Minimize Institutional Barriers.

Develop a comprehensive program that considers and suggests treatments of ecological problems and opportunities in an over-arching manner based on ecological priorities. Cost sharing requirements could be changed (through legislation) to attract more potential non-Federal sponsors that border the Ohio River. Other institutional problems include limited funds at the state or local level and the limited types of projects applicable under existing authorities. Further reduction of non-Federal cash expenditures could be realized by allowing sponsors full credit for work they would do during the feasibility phase of site-specific studies.

Opportunity 2: Restore Riparian Corridors, Reduce Fragmentation by Expanding and Joining Isolated Habitat Blocks and Stabilize Eroding Banks.

Inventory and identify unique habitats and those areas with the most intact habitat blocks that warrant protection and work with partners through conservation easements, acquisition, and land use planning to protect habitats. Conduct threat analyses for high priority habitats and work with partners to design and implement measures to eliminate or reduce threats (e.g., erosion control, runoff). Work with Federal, state, local, and private partners to restore vegetated riparian corridors. In particular, reduce fragmentation by expanding and joining isolated habitats, and stabilize eroding banks.

Opportunity 3: Restore, Protect Existing Islands And Create Islands Where They Historically Occurred.

Inventory and identify important island habitats and those areas with the most intact habitat blocks that warrant protection and work with partners through conservation easements, acquisition, and land use planning to protect them. Conduct threat analysis for high priority island habitats and work with partners to design and implement measures to eliminate or reduce threats (e.g., erosion control and runoff). Restore existing islands and construct new islands in areas where they historically occurred or where, under current hydrologic conditions, they may be created. This could be accomplished in part by the use of dredged materials.

Opportunity 4: Restore Floodplain Forests.

Inventory important floodplain habitats and those areas with the most intact habitat blocks that warrant protection. Work with partners through conservation easements, acquisition, and land use planning to protect them. Conduct threat analysis for high priority floodplain habitats and work with partners to design and implement measures to

eliminate or reduce threats (e.g., erosion control, runoff, and drains). Work with Federal, state, local, and private partners to reforest as much of the floodplain as possible with native hardwoods, focusing on high priority areas. Reduce fragmentation by expanding and joining isolated habitat blocks.

Opportunity 5: Restore Unusual Habitats (e.g., Canebrakes, River Bluffs, and Mussel Beds) .

Inventory and identify important habitats that warrant protection and work with partners through conservation easements, acquisition, and land use planning to protect them. Conduct threat analysis for high priority habitats and work with partners to design and implement measures to eliminate or reduce threats (e.g., erosion control and runoff). Restore canebrake habitat as part of the normal mosaic of habitats in the lower half of the Ohio River ecosystem. Creation of areas conducive to natural development of these habitats should also be attempted.

Opportunity 6: Restore Bottomland Hardwood Forests.

Inventory and identify bottomland hardwood forest remnants and those areas with the largest intact habitat blocks for protection. Utilize existing resource management plans such as the North American Waterfowl Management Plan, the Partners in Flight Migratory Bird Action Plans, and the Western Hemisphere Shorebird Network Management Plans, as well as state management plans, to identify high priority areas for protection, maintenance, and restoration of bottomland hardwoods. Develop and maintain a Geographic Information System (GIS) database for these areas. Protect existing high priority bottomland hardwoods through acquisition, conservation easements and other partnerships with conservation groups, industry, private landowners, and citizen watershed groups. Restore bottomland hardwoods in high priority areas in partnership with Federal and state agencies and private landowners/conservation groups.

Opportunity 7: Restore & Protect Wooded Wetlands: Forested Swamps and Scrub/Shrub Wetlands.

Inventory and identify wooded wetland habitats and those areas with the most intact habitat blocks that warrant protection. Utilize existing resource management plans such as the North American Waterfowl Management Plan, the Partners in Flight Migratory Bird Action Plans, and the Western Hemisphere Shorebird Network Management Plans, as well as state management plans, to identify high priority areas for protection, maintenance, and restoration of cypress/tupelo swamps and other forested habitats. Develop and maintain a GIS database for these areas including identification of various habitat types. Construct moist soil impoundments in high priority areas that would be conducive to both woody and emergent vegetation and create exposed mud/sand flats to benefit a wide variety of wildlife including waterfowl, shorebirds, reptiles (such as the copper-belly water snake), and other species. Develop a mosaic of habitats to provide refuges for insect, crustacean, amphibian and fish species, and also provide emergent, scrub/shrub and forested wetlands that function as important migratory bird foraging areas, juvenile fish rearing areas, and other wildlife/fishery values. Provide structure/habitat diversity for all aquatic species. Increasing overall habitat complexity may slow the rapid and successful colonization of large areas by nonnative species such as the zebra mussel. Protect existing high priority areas through acquisition, conservation easements and other partnerships with conservation groups, industry, private landowners, and citizen watershed groups. Restore high priority areas in partnership with federal and state agencies and private landowners/conservation groups.

Opportunity 8: Restore & Protect Backwaters (e.g., Sloughs, Oxbows, Embayments, and Bayous).

Identify areas where backwater habitats are limited. Construct backwater areas through the use of off-bank revetments, reclamation of abandoned gravel mines, beneficial use of dredged material, etc. Wherever possible, snags would be left in place or artificial structures would be introduced in these areas. These features would not obstruct or endanger navigation traffic.

Opportunity 9: Restore & Protect Riverine Submerged And Emergent Aquatic Vegetation.

Inventory pools on the Ohio River mainstem to identify those pool reaches with the topography and other features that would allow for establishment of aquatic vegetation beds. Develop and maintain a GIS database for these areas. Work in concert with other user groups to develop and implement an environmental pool management strategy to favor establishment of aquatic plant beds. Identify areas that could support growth of aquatic vegetation with minor modification of hydrology and/or plantings. These data would be entered into existing GIS databases. Install structures to modify hydrology in candidate areas, taking precautions to ensure that modifications would not interfere with other uses.

Opportunity 10: Restore, Protect and Create Sand and Gravel Bars.

Data related to important sand and gravel bar areas would be entered into existing GIS databases. Existing mechanisms, including the Section 404 and Section 10 permitting processes, provide opportunities to protect important habitat areas. The Corps, USEPA, USFWS, and States, using existing data, would work with applicants to avoid these important habitat areas or to encourage applicants to restore some areas as mitigation for permitted actions. Other protective measures could include installation of mooring cells or buoys upstream and downstream of locks and other identified problem spots to relieve emergency or impromptu beaching of tows and barges in environmentally sensitive areas. Identify areas where sandbars may be enhanced through the addition of gravel or structures to increase flushing of silt from the gravel beds. Identify areas (i.e., less than 9 feet deep) that would benefit from adequate current to allow for scouring of sediments to create gravel beds in areas that do not interfere with other authorized uses of the river.

Opportunity 11: Protect and Improve Tailwaters and Provide Structures to Provide Refuge for Fish.

Tailwaters of locks and dams are a significant riverine habitat. They are important because they facilitate exchange of dissolved gases and provide significant spawning and feeding habitat for several fish species. Opportunities for tailwater restoration include modification of hydrology through flow training structures, installation of physical habitat features, modifications to existing lock and dam structures, and measures to improve dissolved gas exchange. Modifications to structures will not impede or alter navigation traffic or operation and maintenance of facilities.

Opportunity 12: Create, Protect and Improve Fish and Mussel Refuges in Pools.

Identify areas in each pool where various structures could be placed that would not conflict with other uses such as navigation. Data would be managed through existing GIS databases for these areas. Identify partners for construction and placement of structures and landowners willing to have such structures placed. Install habitat diversity structures including chevron dikes, off-bank revetments, and side channel hard points.

Wherever possible, snags would be left in place or artificial structures would be introduced to improve habitat complexity.

Opportunity 13: Restore and Protect Side Channel/Back Channel Habitat.

Side channel/back channel areas would be inventoried for potential protection, restoration, construction, and enhancement activities. Side channel/back channel habitats are associated with island habitats. Therefore, activities under this opportunity would be complimentary with those under Opportunity 2. Protect and enhance existing islands to improve associated back channel habitat. Plantings, hard structures and dredged material disposal are some of the resources that could be used to protect islands. Identify areas

where islands previously existed or where new islands could be created to provide valuable back channel habitats without substantial interference with other users. Chevron dikes with dredged material disposal is one method that could be used. Use wing dams and other structures to constrict side channel/back channels to increase velocity and scouring in targeted areas and to provide refugia when needed from currents. Use dredged material (sand and gravel) to improve habitat. Add structures such as emergent dikes, artificial reefs, and snags to these areas. As much as possible, allow snags to remain in these areas. Data on these habitat types would be managed through GIS databases.

3.5.1 Development of Example Projects

Translating the above opportunities into actions required the team to undertake a process of identifying, developing, and evaluating certain specific projects as examples of individual actions that could be undertaken. This was done to ensure the actions would contribute to attainment of the opportunities, as well as to make preliminary determinations of the scope, costs, and benefits of individual actions that may be implemented under an ecosystem restoration program. The team identified over 250 potential site-specific projects within the Ohio River corridor for possible implementation; however, it is noted that none of these projects are recommended for authorization or approval as part of this study report. This in no way reflects on the merit of any of the possible projects; undoubtedly, some of the 250 projects would eventually be implemented once a program is authorized. Several of these projects may also be considered as mitigation for navigation improvements or be implemented under existing continuing authorities for ecosystem restoration. If a project was determined to be suitable mitigation for navigation or other impacts, that project would no longer be considered under the proposed ecosystem restoration program. Appendix G provides five project examples of the types of measures that could be implemented under the proposed program. Again, none of these projects are being recommended for authorization in this report. They are presented to provide detailed examples of some of the types of measures expected to be implemented under the recommended program. Table 3-1 provides a general listing of the variety of projects envisioned for implementation by the partnership.

TABLE 3-1

General Project Types

GENERAL PROJECT TYPES	HABITAT CREATED/PROTECTED/RESTORED
Chevron Dikes	Create avian nesting and feeding habitat, increase aquatic habitat diversity for fish and benthos.
Off Bank Revetments	Create aquatic habitat diversity, and provide shelter during winter flows, provide structure for increased offshore fishing, facilitate development of a sustained, diverse fishery resource.
Side Channel Hardpoints	Increase aquatic habitat diversity for fish and benthos.
Island Creation	Create off-channel habitat, increase aquatic habitat diversity and increase fish spawning habitat, create terrestrial and riparian habitat and wetland habitat.
Embayment Restoration	Deepen silted embayments, enhance access for fish, increase deepwater aquatic habitat diversity and improve fish spawning habitat, provide over-wintering habitat for various fish species.
Stream Shoreline Restoration	Improve riparian habitat for wildlife, reduce soil erosion, provide aquatic habitat diversity.
Backwater Area Restoration	Provide reproductive, feeding, nursery, feeding and over-wintering habitat for riverine fish and provide habitat for migratory waterfowl, wading birds and other wildlife.

SECTION 4

PLAN FORMULATION

4.1 ASSESSMENT OF WATER RESOURCES AND RELATED LAND RESOURCES PROBLEMS AND OPPORTUNITIES

4.1.1. Existing Conditions

The Ohio River drainage basin lies in the Middle Eastern portion of the United States. The basin is approximately 300 miles wide and about 1000 miles long. The study area for this report encompasses only the Ohio River mainstem and its approximate 100-year floodplain.

Appendix F of this report provides a detailed description of the geography, geology, climate, vegetation, wildlife and other physical and environmental characteristics of the Ohio River basin. The U. S. Fish and Wildlife Coordination Act Report (Appendix D) also contains descriptions of the Ohio River corridor and its resources. Population statistics and a list of cities and towns are included in Appendix B.

4.1.2. Future Without Ecosystem Restoration Program (No Action Alternative)

In the absence of an Ecosystem Restoration Program for the Ohio River, substantial benefits to terrestrial, wetland, and aquatic habitats would not accrue in and along the Ohio River corridor. Based on the number of projects implemented along the Ohio River under the existing Sections 1135 of WRDA 1986 (project modifications for fish and wildlife) and 206 of WRDA 1996 (aquatic ecosystem restoration) programs to date, it is liberally estimated that no more than 30 more projects are likely to be implemented over

the next 50 years under these authorities. As a result, it is expected that there would continue to be a net degradation of various components of ecosystems along the Ohio River Mainstem. Under the No Action Alternative, the following conditions and degradation would be expected to continue:

A. Terrestrial Habitats

As a consequence of past and on-going development throughout the Ohio River floodplain, much of the forested bottomlands have been converted to agricultural and other uses. This has caused fragmentation of habitats and degradation of riparian areas. Riparian Corridors along the Ohio River are likely to continue to be subject to streambank erosion, urban development and clearing for agriculture. Continued fragmentation of riparian areas including isolation of habitat blocks and islands will probably occur. Loss of islands or portions of islands throughout the river would continue. Nineteen islands of the U.S. Fish and Wildlife Refuge on the Upper part of the Ohio River Mainstem would continue to be threatened. Floodplain habitats would continue to be threatened and converted to other uses. For example, vegetated areas surrounding sloughs and old oxbows in private ownership could be lost or degraded by change in land use in the vicinity of those areas. Loss or degradation of vegetation surrounding the slough and old oxbow areas is likely to occur in the future without program. Unique habitats such as cane breaks in the lower half of the Ohio River ecosystem would continue to be threatened. In some cases the cane breaks may be destroyed or damaged.

In the future without program (No Action Alternative), the diversity and abundance of wildlife would decline. More generalist species would be favored, and sensitive species would likely decrease in number. Continued development of the shoreline and floodplain would adversely impact terrestrial habitat values. Greater development pressures will likely be placed on shoreline and floodplain habitats.

B. Wetland Habitats

As throughout the nation, wetlands within the Ohio River floodplain have been destroyed and modified resulting in relatively small, isolated patches of wetlands remaining. Without an Ecosystem Restoration Program for the Ohio River, some unique bottomland hardwood habitats (especially wetlands) would still be protected to some extent through existing regulatory programs. Other habitats important to wetland complexes such as buffer zones are, however, unprotected under current regulatory programs. There would likely be relatively few wetland acres restored. Forested wetlands such as cypress/tupelo swamps and other unique forested wetlands would not benefit from acquisition and restoration efforts of partnerships among federal and state agencies, landowners, local government, and conservation groups. High priority areas such as scrub/shrub and emergent wetlands (including scrub/shrub wetlands in embayments and island sloughs) would continue to be threatened. Construction of moist

soil management units are not likely, resulting in loss of opportunity to create both emergent and submerged aquatic wetlands and exposed mud/sand flats to benefit a wide variety of wildlife including fish, waterfowl, shorebirds, reptiles (such as the copper belly water snake), and other species.

C. Aquatic Habitats

Aquatic habitats such as backwater and side channel areas are vital production and nursery sites for several sport, food, and forage fishes. Without adequate protection of these habitats, it would be difficult to maintain a healthy Ohio River fishery (Henley 1995). The value of the Ohio River embayments to fisheries resources is of particular concern to the various state fisheries agencies. Ohio River embayments were formed at small tributary mouths with the development of the navigational pools. The rise in river elevation created these off-channel areas, which are highly productive aquatic habitats. They now also serve as sediment sinks. As waters from free-flowing tributaries encounter the slack water created by impoundment, their sediment loads drop out into the basin of the embayment. Over time, these areas have gradually silted in, resulting in reduced aquatic habitat diversity by covering structure and providing somewhat uniform depths.

In the without program (No Action) condition, backwater areas (including sloughs, oxbows, embayment areas and bayous) would continue to be degraded by sedimentation, resulting in loss of important fish/spawning, nursery, and food production areas. Continued sedimentation of backwater areas would also reduce availability of winter habitat for fish. Opportunities to identify and modify areas that could support aquatic vegetation will likely not occur. Projects to enhance in-river sand and gravel bars would also not occur under the without program condition. The result would be no improvement of these important transition areas that have already been made scarce as a result of creation of large navigation pools. Few projects involving chevron dikes, off-bank revetments, and side channel hard points would be constructed in the future.

There are a number of authorities available to Federal agencies at present to address ecosystem restoration projects, and these are included in the No Action Alternative. However, because these authorities are implemented on a project-by-project basis, they do not provide the comprehensive approach that a new program would provide. See Appendix I for a description of the various authorities available to Federal Agencies.

D. Socioeconomics

There are seven standard metropolitan statistical areas (SMSAs) along the main stem of the Ohio River. These areas support some 8 million people and their industrial, agricultural, commercial, and recreational pursuits. Human activities--economic, social, and cultural--have important impacts upon the environment. Conversely, the condition of

the environment surrounding the Ohio River Valley directly and indirectly affects the well being of the inhabitants of the six-state area through which it flows. “Quality of Life” factors continue to become major considerations in where businesses and individuals choose to locate. These factors may be expected to continue improving, as they have over the past quarter century under the No Action Alternative. However, such improvements would be relatively slow developing, as remaining environmental problems may be a greater challenge than those previously tackled.

4.1.3 Specific Problems and Opportunities

The general and specific restoration and administrative problems to be addressed are presented in Section 2 of this document. Section 3 describes the restoration objectives and goals to be achieved. Following is a description of the Alternatives considered that could meet many of the objectives. Some features of some Alternatives are outside current restoration authorities and policies of the Corps. However, nothing is suggested that is beyond practical current technologies.

There are numerous specific problems affecting ecological resources throughout the Ohio River corridor. Detailed evaluations of the problems and opportunities are in Appendix A. However, the single, over-riding obstacle is the fragmented approach taken so far in ecosystem restoration efforts. There is no comprehensive planning that integrates the efforts of the various participants to help ensure efforts and resources are directed towards the highest priority needs.

As a result of the ORMSS, an opportunity exists to establish a comprehensive ecosystem restoration program authority that evaluates, plans, and prioritizes against the backdrop of existing programs (see Appendix I for discussion of existing authorities). Such an authority would compliment existing programs through cost-effective partnering among resource agencies to restore important resources not included under current programs.

Through an ecosystem restoration authority specific to the Ohio River corridor, there is an opportunity to accomplish the following:

- restore 25,000 acres of bottomland hardwood forests,
- improve 1,250 acres of aquatic habitat,
- restore/protect 40 islands,
- improve 100 miles of shoreline/riparian habitat, and
- restore 25,000 acres of wetlands.

4.2 PLANNING CONSTRAINTS

The most important constraint of any program is that it produces a comprehensive ecosystem management program for the Ohio River Corridor. Other constraints that limit the planning process for the Corps are resource constraints, and legal and policy constraints. Resource constraints are those associated with limits of knowledge, expertise, experience, ability, data, information, money and time. Legal and policy constraints are those defined by law, Corps policy, and guidance.

The Corps' overall objective in ecosystem restoration planning is to contribute to National Ecosystem Restoration (NER outputs from a project) through increases in the net quantity and/or quality of desired ecosystem resources. The proposed restoration program for the Ohio River would meet the Federal Objectives described in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G). Those guidelines would also be used to formulate and evaluate ecosystem restoration projects as described in Section 6, Program Implementation.

As a general rule, projects must be formulated to reasonably maximize net benefits to the national economy, to the environment or to the sum of both. Both the programmatic level alternatives and alternatives for each individual project under the Ohio River Ecosystem Restoration Program would be formulated in consideration of four criteria described in ER1105-2-100: completeness, efficiency, effectiveness, and acceptability. Completeness is the extent to which the alternative plans provide and account for all the necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities. Effectiveness is the extent to which an alternative plan contributes to achieving the planning objective. Efficiency is the extent to which an alternative plan is the most cost effective means of achieving the objectives. Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies.

Additional programmatic constraints would be:

- Completeness of the program,
- System-wide effectiveness of the program,
- Synergistic effects of individual projects of the program,
- Economic & Ecosystem feasibility of the program,
- Environmental acceptability the program,
- Documentable ecosystem improvements,
- Institutional acceptability of the program,
- Public acceptability of the program, and
- Nonfederal sponsors acceptance of sponsorship requirements.

4.3 FUTURE WITH ECOSYSTEM RESTORATION PROGRAM

4.3.1 Alternatives Eliminated

General Investigation Alternative

A single legislated project to address all the restoration and administrative problems was considered. However, the intricacies of working on 250+ individual sites that are spread over six states was considered administratively insurmountable. The inequity of capabilities and benefits among the non-federal sponsors would preclude reasonable allocation of cost-sharing. This alternative could consist of at least one authorized project for each state along the river. This would reduce the interjurisdictional issues among the states. However, the authorities could differ from state to state and there would be no coordination of a comprehensive, prioritized, length-of-river management plan. Further, this approach fails to meet the criteria of Acceptability, Completeness, System-wide Effectiveness, and Synergistic Benefits.

4.3.2. Federal Action Alternatives Considered In Detail

Two Federal Action Alternatives were considered in detail. The New Program Alternative consists of developing a new program that would be consistent with existing laws on cost-sharing and Corps policy on crediting work-in-kind and the types of projects that may be implemented, etc. The second action alternative was the Regionally Preferred Alternative that expands the physical nature of the projects allowable, changes the cost-share ratio, and expands what may be credited as work-in-kind. Both alternatives focus on comprehensive ecosystem restoration and management.

4.3.3 Presentation & Evaluation of Final Array Of Alternatives

The following sections describe the two Federal Action alternatives. The implementation procedures common to both alternatives are provided in Section 6, Program Implementation.

4.3.4 New Program Alternative (Based on Corps Policy)

Ecosystem restoration is one of the primary missions of the Corps Civil Works Program. The Corps of Engineers has implemented ecosystem restoration projects throughout the country, and additional projects are being planned for the future. ER 1165-2-501 describes Corps policy in implementing restoration projects. The Engineering Regulation describes various ways projects can be authorized and types of projects in which the Corps may participate. As explained in the ER, projects implemented should address the restoration of ecosystems. Restoration opportunities that require engineering features that are associated with wetlands, riparian and other floodplain and aquatic systems are likely to be most appropriate for Civil Works ecosystem restoration investments. Projects that are primarily land acquisition are not appropriate as Civil Works Ecosystem restoration investments. Under this alternative, an ecosystem restoration program for the Ohio River would conform to Corps policy described in ER 1165-2-501. The Ohio River Program would also be consistent with EP 1165-2-502, **Ecosystem Restoration-Supporting Policy Information** and ER 1105-2-100, **Planning Guidance Notebook**.

The following features are included in the Program Alternative based on Corps policy:

1. Projects implemented under this program would be cost shared. The Federal cost under the program would have a cost of 65% of the total implementation cost. The non-Federal share would be 35% of the total implementation of a project.
2. The non-Federal sponsor would be required to provide all lands, easements, right-of-ways, relocations, and disposal sites (LERRDS) for the project. When LERRDS are expected to exceed 35% of the total project cost, the non-Federal sponsor would be reimbursed for the additional LERRDS. The Government may, at its option, assume financial responsibility for payment of the portion of the LERRD's that exceeds 35 percent of the total project cost.
3. Funds from another Federal agency may be used as the non-Federal share of Corps projects when the other Federal agency certifies in writing that the use of such funds for that purpose is authorized.
4. The non-Federal sponsor would be responsible for operation, maintenance, repairs, rehabilitation, and replacement (OMRR&R) of the individual project once it is completed. The Districts would prepare O&M manuals in accordance with ER 1105-2-401.
5. For projects on Corps lands, a non-Federal sponsor would be responsible for cost-sharing and OMRR&R. Specific projects would be monitored on a case-by-case where there is uncertainty that the project would function as designed. Monitoring is part of project implementation and would be a basis for "lessons learned" to be applied to the future projects.

6. The Corps and its environmental partners would update and refine the stated opportunities of the program during preparation of the Program Implementation Plan (PIP). A long-term habitat needs assessment may be required in the future. There is no existing authority for a fully federally funded assessment. A major portion of this type of evaluation would normally be part of a feasibility study and cost-shared in accordance with ER1105-2-100, Chapter 2, Paragraph 2-8c.
7. A non-Federal sponsor would be responsible for cost sharing projects to be implemented at Federal facilities such as locks, dams and power plants that are operated and maintained by the Corps of Engineers and not leased to another agency, group, or individual. For such projects, the Corps may assume responsibility for the cost and performance of OMRR&R, however specific approval would be required from the Division Commander when OMM&R costs are expected to exceed \$5,000 annually.
8. Following completion of the specific projects, the Corps would periodically inspect projects.
9. A program implementation report would be prepared in the first year of the program and a comprehensive strategic plan would be included as part of that report. Where other lands of other Federal agencies would be used for a restoration project, e.g., Department of Interior or Department of Agriculture lands, the Corps would not use Civil Works funds to implement a project. The non-Federal sponsor would be responsible for coordinating implementation and OMRR&R with the hosting Federal agency.
10. The program would be authorized with maximum Federal Funding of \$10 million annually for each of the first 5 years and \$15 million annually, thereafter.
11. The 1 percent for monitoring and the 3 percent adaptive management funds would be included in the total costs of Project Implementation Report (PIR).

4.3.4.1 Costs And Benefits Of The New Program Alternative (Based on Corps Policy)

The total cost of the new program alternative is estimated to be \$308 million. The estimated Federal cost is \$200 million. Total estimated nonfederal share is \$108 million plus the cost of OMRR&R.

The estimated benefits of the Recommended Alternative for an Ecosystem Restoration Program for the Ohio River include the following:

- restore 25,000 acres of bottomland hardwood forests,
- improve 1,250 acres of aquatic habitat,
- restore/protect 40 islands,
- improve 100 miles of shoreline/riparian habitat, and
- restore 25,000 acres of wetlands.

One of the major benefits of an ecosystem restoration program on the Ohio River would be the comprehensive and cooperative ability by many partners to collectively focus on the Ohio River ecosystem and to effectively plan individual efforts within the context of the over-arching program. One of the initial efforts under the Ohio River Ecosystem Restoration Program would be development of a strategic Program Implementation Plan (PIP) to effectively evaluate and prioritize restoration efforts within the limited resources available to all the groups participating. Through a coordinated partnership among agencies, Federal and nonfederal sponsors, environmental groups, academia, interested users of the Ohio River and private entities, a synergy can be created to better optimize available resources. Such a program plan would be a significant improvement over the fragmented approach currently in effect through the various agencies, groups and individuals. During the formulation of the PIP, the Corps of Engineers and its partners will review and refine the restoration goals. Committees formed under this program may need to comply with Appendix B, paragraph B-10, ER1105-2-100.

4.3.4.2 Summary of Alternative

The Preferred Alternative meets the planning criteria with one possible exception. The preferred plan may not satisfy the criterion of nonfederal sponsorship of individual projects. Although not all of the potentially eligible sponsors have participated in development of the program, the potential sponsors at the state natural resources agencies

have expressed their desires for more favorable cost sharing and work-in-kind arrangements.

4.3.5 Regionally Preferred Alternative

4.3.5.1 Views Of The Regional Partners Concerning An Ecosystem Restoration Program For The Ohio River

There is significant interest and support at the regional level for an ecosystem restoration program for the Ohio River. Letters of support have been received from five states (See Appendix E) and the other state in the region has informally indicated a letter is forthcoming. The states have expressed several concerns about certain provisions of the recommended alternative. As a result of discussions with the states, a regionally preferred program has been developed. This regionally preferred program was developed to represent a synthesis of ideas obtained during discussions with the potential partners at the state natural resource agency level.

4.3.5.2 Regionally Preferred Program

The Regionally Preferred Plan includes the provisions within the New Program Alternative (based on Corp policy), except for the revised cost sharing ratio and additional items indicated below. As in the New Program Alternative, the PIP will describe the activities that will be conducted during detailed planning to evaluate and select alternatives. If included within legislation, it is recommended that annual Federal funding limits be considered for items d through f. Features of the regionally preferred program are as follows:

- a. Cost sharing would be 80 percent Federal and 20 percent Non-federal to permit implementation of a greater number of ecosystem restoration projects within limited available funding by states and other non-Federal sponsors. Federal cost for the Regionally Preferred program would be \$200 million and non-Federal share would be \$50 million.
- b. Non-Federal sponsors would receive full work-in-kind credit for studies, engineering and design services directly related to implementation of site specific projects. To receive full credit, sponsors would be required to perform and complete the services within 5 years prior to execution of the Project

- c. Cooperation Agreement (PCA) for funding and implementing a project. Non-Federal sponsors would also receive work-in-kind credit, similar to existing ecosystem restoration authorities, for construction activities performed after PCA execution.
- d. State and local agencies would be permitted to use Federal grant monies, designated for environmental improvement projects, as non-Federal funding for implementation of Ohio River ecosystem restoration projects.
- e. The study, design, and implementation of projects constructed on Federal lands would be 100 percent Federally funded. The Federal agency, which owns the property, would be responsible for operation, maintenance, repair, rehabilitation, or replacement (OMRR&R) of the project.
- f. Projects implemented specifically for restoration and protection of Federally listed threatened or endangered species and critical habitat would be 100 percent Federally funded.
- g. Projects implemented to restore and protect Federal Trust Resources protected by specific law, treaty, or international convention would be cost shared at 100 percent Federal cost.
- h. The program would include funding to monitor the long-term overall health and needs of the Ohio River ecosystem. These efforts would provide an objective, cost-effective basis for prioritizing and implementing site specific projects and provide information needed to conduct an assessment of the health of the Ohio River ecosystem. Monitoring of specific projects, when appropriate, would be cost-shared similar to the requirements of existing ecosystem restoration authorities.
- i. The Corps of Engineers would consider implementation of land intensive projects, such as reforestation of wetlands, even when land acquisition costs would exceed 50 of total implementation costs.
- j. Project planning and design would be 100% Federal cost.
- k. A habitat needs assessment would be conducted at Federal expense to further refine program goals.

4.3.5.3 Costs and Benefits Of The Regionally Preferred Program Alternative

The total implementation costs of the regionally preferred program alternative are estimated to be \$250 million. The estimated Federal cost is \$200 million. The total estimated nonfederal share is \$50 million plus the cost of OMRR&R.

The types of benefits of the Regionally Preferred Alternative for an Ecosystem Restoration Program for the Ohio River would be the same as those of the Recommended Alternative.

One of the major benefits of an ecosystem restoration program on the Ohio River would be the comprehensive and cooperative ability by many partners to collectively focus on the Ohio River ecosystem and to effectively plan individual efforts within the context of the over-arching program. One of the initial efforts under the Ohio River Corridor Ecosystem Restoration Program would be development of a strategic Program Implementation Plan (PIP) to effectively evaluate and prioritize restoration efforts within the limited resources available to all the groups participating. Through a coordinated partnership among agencies, Federal and nonfederal sponsors, environmental groups, academia, interested users of the Ohio River and private entities, a synergy can be created to better optimize available resources. Such a program plan would be a significant improvement over the fragmented approach currently in effect through the various agencies, groups and individuals

4.3.5.4 Summary of Alternative

The Regionally Preferred alternative meets the planning criteria with one exception. This alternative does not satisfy the criterion of institutional acceptability of the program because it would not be consistent with current law and policy for ecosystem restoration.

4.3.6 Environmental Consequences

Environmental effects of the three alternative plans previously described are evaluated. Due to the programmatic context of this Integrated Decision Document/ Environmental Assessment, the impact assessments are cumulative in nature. That is, they are based on full implementation of each alternative evaluated in detail.

4.3.6.1 Alternatives

The three alternatives are:

- No Action,
- Establishment of an Ecosystem Restoration Program Consistent with Existing Corps Policy (Corps Preferred Alternative), and
- Establishment of an Ecosystem Restoration Program that Incorporates Features desired by Potential Non-federal Sponsors (Regionally Preferred Alternative).

Table 4-1 below provides a brief summary of the anticipated environmental consequences for each alternative. A detailed environmental analysis is provided within the sections immediately following the table.

TABLE 4-1

Environmental Considerations.

Resources And Environment	Alternatives/Consequences		
	No Action	Corps Preferred	Regionally Preferred
Soils and Geology	No change in conditions and processes.	Short-term soil disturbances during project implementation. Long term erosion control at specific sites.	Short-term soil disturbances during project implementation. Long term erosion control expected at a greater number of sites.
Hydrology	No significant change.	No significant change.	No significant change.
Aquatic Resources	Continued recovery due to water quality improvements.	Further improvements by creation of habitats.	Further improvements by creation of habitats. More projects expected with this plan.
Wetlands	Losses would continue at slow rate.	Substantial improvements.	Substantial improvements. More projects expected with this plan.
Terrestrial Resources	Little change expected to occur.	Substantial improvements.	Substantial improvements. More projects expected with this plan.
Land Use	No appreciable change.	No appreciable change.	No appreciable change.

Air Quality	No appreciable change.	No appreciable change.	No appreciable change.
Cultural Resources	Little change.	Impacts may occur at site-specific projects. Program implementation would result in improved protection of previously unknown archaeological sites.	Impacts may occur at site-specific projects. Program implementation would result in improved protection of previously unknown archaeological sites. More projects expected with this plan.
Recreation	Improvements likely.	Additional minor recreational features in accordance with Corps policy.	Additional minor recreational features in accordance with Corps policy. Possibly a few more features with this plan.
Socio-economics	No significant change.	Slight improvements in “quality of life” factors.	Slight improvements in “quality of life” factors. More projects expected with this plan.
Aesthetics	No anticipated change.	Improvements for some projects; detractions for others.	Improvements for some projects; detractions for others.
Noise	No anticipated change.	No anticipated change.	No anticipated change.
Hazardous, Toxic, and Radiological Wastes	No change.	No change. Projects would not be located in those areas.	No change. Projects would not be located in those areas.

4.3.6.2 Soils and Geology

Detailed information on soils and geology are in Appendix F. The Ohio River flows through four physiographic provinces. The river begins on the Appalachian Plateau, proceeds through the northern part of the Interior Low Plateau where it serves in some places as the boundary between the Interior Low Plateau and the Central Lowlands, then enters the Coastal Plain where it converges with the Mississippi River.

The Ohio River Basin is underlain by a wide variety of bedrock units ranging in age from Precambrian Era (600 million years old) in the New River Basin in North Carolina and Virginia to Cenozoic Era (recent) at the head of the Gulf Coastal Plain

where the Ohio empties into the Mississippi River. These two extremes in age are, however, represented by only very small areas of outcrop. The vast majority of the basin is underlain by Paleozoic rocks. Rock strata from all of the systems of the Paleozoic Era are present in the basin.

The various stratigraphic sequences are layered, interrupted, tilted, and generally controlled by the structural configuration of any area. The eastern boundary of the Ohio River watershed is formed by the Appalachian Mountains from Pennsylvania to Tennessee. This boundary is also the eastward limit of the vast deposits of thick, Paleozoic Era sedimentary rocks which form the bulk of the stratigraphic sequence for the Ohio River Basin. The tight folding and faulting associated with the bedrock units adjacent to the mountains softens into slightly undulating to nearly horizontal layers of sediments to the west. These sediments represent the erosional products of the former Appalachian Mountains. This layered structure is interrupted by two important geologic structures, the Cincinnati Arch and the Nashville Dome. These structures tend to bow-up the sedimentary sequence and have allowed erosional processes to expose older rocks which crop out in areas surrounded by younger rocks. Some rather complex geologic structures interrupt this orderly layering of the bedrock units in the extreme western portion of the Ohio River Basin. Here folding, faulting, and subsequent erosion have left sudden changes in the stratigraphic sequence. Out of this complex structural area, the Ohio flows across the thick recent sedimentary deposits of the great Mississippi Valley.

The alluvial sediments on the upper Ohio River Valley consist of glaciofluvial fill of medium-coarse grained sand and gravel of Wisconsin Stage and post-glacial terrace deposits mainly of the "point-bar" type of river sediment. These glaciofluvial deposits are as much as 125 feet thick and are composed of 45 to 83 percent locally derived pebbles of Pennsylvanian and Permian rock derivation and foreign pebbles. Granite, quartzite, vein quartz, and chert pebbles comprise the foreign material that has been introduced into the watershed by glaciation. The sedimentary structures are predominantly the cut and fill type that is characteristic of aggrading streams. The individual beds are highly lenticular and there are abrupt changes in particle size, both horizontally and vertically. The floodplains commonly consist of thick sections of sand, silt, and clay that are commonly referred to as loams. Eolian deposits, known as loess, occur as a blanket deposit along the Ohio in the Purchase and Western Coal Field regions. Away from the river, these deposits grade into loams. East (upstream) of Mile 785 and the Green River, there is very little typical loess.

Under the No Action Alternative, the conditions and processes affecting soils and geology would continue to occur. There would be no changes to these conditions and processes. Implementation of either program alternative would have no potential to affect geologic formations or many of the processes acting upon the formations. Because several program activities would involve localized soil disturbances or alteration of erosional processes along the river, there would be some impacts to soils. In the short-term, measures would need to be incorporated to minimize soil erosion during periods of disturbance. Over the long-term, most of the measures implemented would tend to stabilize existing conditions by holding soils in place. Further, in many areas where

ecosystem restoration would be implemented, rebuilding of the topsoil layer is expected to occur. Impacts to soils are expected to be greater under the Regionally Preferred Program Alternative because it is expected that more projects would be implemented under that program than under the Corps Preferred Alternative.

4.3.6.3 Hydrology

The Ohio River is a relatively stable river when compared with other systems of similar size and type. This is verified by considering the hydraulic relations for a variety of rivers and comparing conditions that occur on the average for other alluvial river systems. The Ohio River is narrower than alluvial channels commonly studied. Also, the depth is greater and the width-depth ratio is smaller. The relationship of these three parameters, when compared to other alluvial rivers, demonstrates that the Ohio River is in fact a very stable river. The fact that these three parameters orient themselves this way in relationship to the trends established by studying other alluvial rivers verifies that the Ohio River is in fact very stable.

Within the Ohio River Basin, ground water supplies are obtained from two general sources. Most of the ground water immediately adjacent to the Ohio River is recovered from the fluvioglacial sediments on which the Ohio flows for the greater part of its length. This primary source of water is referred to as alluvial waters. The second source of available ground water is found in the bedrock beneath the alluvial sediments and soils in the region. These are termed bedrock waters, and are the predominant sources of ground water where development of alluvial waters is impractical.

There are approximately 5 million acres of floodplain located along the Ohio River and the lower reaches of its tributaries. Considerable work has been done to mitigate the costly and disastrous consequences of floods. Projects along the Ohio River and its tributaries include flood control reservoirs, levees and floodwalls, stream channel improvements, and other watershed management practices. The Corps of Engineers, as well as other Federal, state, and local agencies are involved in this continuing effort. Restoration of aquatic, wetland, and riparian areas through improved hydrologic connectivity to the Ohio River ecosystem would likely maximize return on investment and respond most directly to implement the program goals. The projects that would be developed through the Corps would require hydrologic connectivity to the Ohio River. Any upland/terrestrial resources restoration opportunities would have to be addressed by some other agency, possibly the US Department of Agriculture. See Appendix I for description of some of their programs.

The present system of the flood control and multipurpose lakes constructed by the Corps of Engineers controls 51,165 square miles or about 31.4 percent of the Ohio River drainage. Kentucky Dam on the Tennessee River, a project constructed by the TVA, provides additional flood control on the lower Ohio River. Also, structures with flood control capacity have been provided by the Natural Resources Conservation Service (NRCS), conservancy districts, several states, and others. This system of reservoirs has

significantly altered flow characteristics of the Ohio River, reducing flood crests, lengthening the duration of bank full stages, and reducing the severity of low flows during drought periods.

Restoration of aquatic, wetland, and riparian areas through improved hydrologic connectivity to the Ohio River ecosystem would likely maximize return on investment and respond most directly to implement the program goals. Upland/terrestrial resources would not address any of the proposed project goals. The Corps of Engineers missions and programs do not include restoration of upland /terrestrial resources. Restoration of terrestrial resources could be addressed by a number of agencies/organizations (see Appendix I).

None of the alternatives would be expected to significantly alter hydrologic conditions of the Ohio River related to channel stability or flooding. Neither would any of the alternatives be expected to affect groundwater resources. Under either of the program alternatives, there would be localized affects on hydrology through actions such as wetland and bottomland hardwood restoration. These effects would primarily consist of some degree of flood attenuation and longer duration retention of water during dry periods. However, considering the extent of water management projects in-place throughout the basin, these would not individually or collectively be expected to change patterns of flood frequency, magnitude, or duration.

4.3.6.4 Aquatic Resources

Water quality of the Ohio River varies with season and flow along its 981-mile long course. Numerous local anomalies can occur, but in general, as the river flows downstream it becomes somewhat warmer and higher in dissolved matter, alkalinity, and planktonic algae density and diversity. The system is highly dynamic and many of these relationships are very complex. Locally, any effluent discharged to the river may affect the quality of the water.

Ohio River water is classified as moderately hard to hard depending on the season of the year, with concentrations showing an inverse relationship to flow. During high flow in winter and early spring, hardness values range from around 80 to over 200 mg/l (as Calcium carbonate). Higher values occur in the downstream reaches. At lower flows during late summer, maximum hardness may range from 200 to over 300 mg/l, with the higher values occurring in the middle and upstream reaches.

The pH of the Ohio River is generally within the ORSANCO limits except for occasional low values in the upper reaches due to acid drainage and high values in the lower reaches due to algal activity. Of the major anions, sulfates generally exceed chlorides, with maximum values reaching 250-300 mg/l and 100-150 mg/l, respectively. Highest sulfate values are generally associated with mine drainage in the upper basin. The major cations of calcium (Ca), magnesium, (Mg), sodium (Na), and potassium (K) generally occur in the following order: Ca > Na > Mg > K, with sodium and magnesium

concentrations approaching one another more closely downstream. With occasional local exceptions of iron and manganese, heavy metals are found generally in low concentrations. Periodic spills of toxic and polluting materials may temporarily affect water quality.

Assimilative capacities of the river have been the subject of many studies, computer modeling, and general concern in the recent past. Dissolved Oxygen (DO) predictions form the basis for calculating these capacities in the river and the overall "quality" of the ecosystem. In general, there is a pattern of DO depression downstream from major population centers, with gradual downstream recovery. Although this pattern remains, the degree of DO depletion has changed radically in the last 25 years as the discharge of raw sewage has been virtually eliminated. Major sewage treatment plants either now or soon would provide secondary treatment, and such improvement would be reflected in increased DO concentrations. Further upgrading of treatment is expected for most systems in the basin.

High bacterial concentrations are associated with major population centers. Improvements in sewage treatment have resulted in significant reductions in coliform bacterial concentrations in the river over the last quarter century.

Phytoplankton are the plant members of the community of floating or weakly swimming organisms (plankton) suspended in a body of water. Because of their physical characteristics, these microscopic plants and animals are unable to overcome passive transport by currents. In the Ohio River, the phytoplankton constitute a large source of organic production. They are consumed by zooplankton, benthic organisms, and planktivorous fish, which are in turn consumed by other fishes of the river. Phytoplankton respond quickly to changes in the aquatic environment due to their short generation time, small size, and intimate contact with the surrounding environment. Natural changes, such as those caused by seasonal cycles, greatly influence trends in abundance and may either mask or complement changes due to human activities.

Zooplankton are the animal members of the plankton community. Zooplankton are important consumers of phytoplankton and are important food sources for benthic macroinvertebrates and fishes. Because of their narrow environmental tolerances, small size, and intimate contact with their surrounding environment, zooplankton populations are rapidly influenced by changes, in the environment. Zooplankton abundance is influenced by phytoplankton abundance, turbidity, sunlight, hydrologic conditions, temperature, and flow rates. More species and more individuals occur in the summer; lower population levels and diversity of species occur in the winter. Ohio River zooplankton populations are usually dominated by rotifers. Cladocerans and copepods (both crustaceans) are also abundant, but are rarely dominant.

Benthic macroinvertebrates consist of those animals which live on or in the river bottom and those which are closely associated with the bottom. Certain benthic species have been described as indicators of sedimentation, water quality changes, flow rates, seasonal fluctuations, and substrate types. They feed upon phytoplankton, organic matter

suspended in the river water, organic matter deposited within the river sediments, and prey upon each other. The composition of benthic communities is highly dependent upon substrate type. Certain communities composed of specific kinds of organisms inhabit riprap, gravel, and boulder substrates, while others occur only in softer substrates.

In an effort to gather information on bottom fauna within the Ohio River Basin and, through continuing studies, to observe changes from year to year due to water quality, Mason et al. (1971) sampled macroinvertebrate populations at 14 Ohio River and tributary stations over a 5-year period, 1963-1967. Data on macroinvertebrate communities were obtained by dredge and artificial substrate (basket) samples collected at the following Ohio River locations: near Pittsburgh, Pennsylvania (River Mile 9); Toronto, Ohio (River Mile 58); Marietta, Ohio (River Mile 168), which was added in 1966; Addison, Ohio (River Mile 260); Huntington, West Virginia (River Mile 301); Cincinnati, Ohio (River Mile 470); Louisville, Kentucky (River Mile 600); Evansville, Indiana (River Mile 787); and Cairo, Illinois (River Mile 980).

Macroinvertebrate populations in the industrialized upper Ohio River were found to be sparse throughout the years sampled, and were characterized by pollution-tolerant and facultative organisms. However, the number and variety of benthic organisms were observed to increase in the middle and lower reaches of the Ohio River as compared to the upper segment. Macroinvertebrates collected immediately downstream from Pittsburgh, Pennsylvania, consisted principally of bloodworms and oligochaetes, many of which are tolerant of low pH and toxic waste. Pollution-sensitive forms were not found at Pittsburgh, but were collected at sampling points further downstream; caddisflies appeared at Toronto, Ohio; mayflies were present 260 miles downstream at Addison, Ohio; and stoneflies were collected at Huntington, West Virginia. However, few organisms lived within the navigation channel proper at the time of the study.

At the conclusion of the 5-year sampling program, Mason et al. provided a provisional "Pollutional Classification of Common Ohio River Macroinvertebrates." Among a total of at least 158 identified taxa, 46 were categorized as "pollution sensitive," 93 were classified as "facultative," and 9 were considered "pollution-tolerant."

Freshwater mussels are another important component of the aquatic environment. Mussels were once abundant throughout the river, but their numbers have drastically declined from historic levels due to water quality degradation, impoundment, and other factors. Several species of mussels are presently listed as Threatened or Endangered by the USFWS. Improvements in water quality over the past quarter century have allowed some recovery of mussel populations in the river. A recent factor, invasion of the river by the exotic zebra mussel, may threaten further recovery of native freshwater mussels due to the zebra mussel's ability to colonize on the shells of native mussels and restrict in-siphoning of water necessary for survival.

Fish populations of the Ohio River have undergone considerable change over the past 200 years. Populations of many species were virtually extirpated from much of the river by degraded water quality and other factors. Improvements in environmental

conditions over the past quarter century have allowed many species to re-establish throughout the river. The river now supports fisheries throughout its length. However, several species (e.g., paddlefish and shovelnose sturgeon) remain of particular concern to natural resource managers. Impoundment of the river has permanently altered aquatic habitats and has favored certain species over those less adaptable to impounded environments. Additional detailed information on aquatic resources is provided in the Fish and Wildlife Coordination Act Report (Appendix D).

Under the No Action alternative, overall conditions are expected to continue to improve. As municipalities and industries upgrade and modernize waste treatment systems, water quality and aquatic life would respond in a positive manner. Remaining problems would be primarily related to degraded habitats and non-point pollution sources (e.g., abandoned mine drainage, sediment laden runoff, etc.). Invasion and expansion by exotic species would continue to be a major concern that could threaten further recovery of aquatic life.

Either of the program plans would build upon and contribute to the recent trends of improvement in the condition of aquatic resources. These would be primarily related to improvements in the quality of high priority habitats. Targeted habitats would be those associated with spawning, nursery, and food production, as well as habitats of limited availability and high importance. Both programs would contribute to reducing sediment and nutrient loads in the river, and may contribute to reduction of other non-point sources. Improvements to water quality, plankton, benthic macroinvertebrates, mussels, and fish would be expected. Improvements favoring native aquatic species may restrict or slow invasion by exotic species by reducing unoccupied niches in the aquatic environment. Improved conditions should occur for Threatened and Endangered species. Because more projects are expected to be implemented under the Regionally Preferred Alternative, impacts to aquatic resources are expected to be greater under that plan than under the Corps Preferred Alternative.

4.3.6.5 Wetlands

Wetlands perform many desirable functions such as flood attenuation, sediment removal, and nutrient removal, as well as providing important fish spawning and nursery habitat, food production areas, and wildlife habitat. Wetlands also make a major contribution to habitat diversity along the river and floodplain. Wetlands of various types were once prevalent along the Ohio River and its floodplain. As a result of development, many wetland areas have been drained or filled and converted to agricultural, industrial, and residential uses. Estimates are that several hundred thousand acres of wetlands have been lost from the Ohio River corridor. Recent emphasis on protection and restoration of wetlands has slowed wetland losses and, to some extent, has resulted in restoration of wetlands.

Wetland losses would continue to occur under the No Action alternative, albeit at a slower rate than historically occurred. Existing programs to protect wetlands are likely to be strengthened, and wetland restoration programs may continue to expand. However,

because not all wetlands are protected, existing programs are not expected to satisfy the national goal of “No Net Loss” of wetlands.

Either of the program alternatives would make substantive contributions to the “No Net Loss” of wetlands goal. These program alternatives would not be expected to take the place of existing regulatory or restoration programs. Rather, they would build upon existing programs within the context of a comprehensive ecosystem restoration effort. The goal of both alternatives would be to restore 25,000 acres of wetlands, or about 3 percent of previous wetland areas. Because more projects are expected to be implemented under the Regionally Preferred Alternative, impacts to wetlands are expected to be greater under that plan than under the Corps Preferred Alternative.

4.3.6.6 Terrestrial Resources

The Ohio River crosses three Regions and seven Sections of the Deciduous Forest Formation of eastern North America, which encompasses the entire Ohio River Basin. These are the Cumberland and Allegheny Plateaus Section of the Mixed Mesophytic Forest Region (upper Ohio River main stem region from Pittsburgh, Pennsylvania, to Portsmouth, Ohio); the Area of Illinoian Glaciation and Bluegrass, Hill, Mississippian Plateau and Mississippi Embayment Sections of the Western Mesophytic Forest Region (lower Ohio River main stem region from Portsmouth, Ohio, to Paducah, Kentucky), and Mississippi Alluvial Plain Section of the Southeastern Evergreen Forest Region (lowermost Ohio River main stem region from Paducah, Kentucky, to Cairo, Illinois).

The mixed mesophytic and western mesophytic forests of Braun have been classified broadly as a "Tulip-Oak Region". The greater part of the tulip-oak forest "lies between 500 and 1,000 feet in altitude, but in places ranges above 3,000 feet. The dense, mixed mesophytic forest contains a fair abundance of two indicator species, white basswood, and yellow buckeye, in a total group of 15 to 20 dominant species."

The Western Mesophytic Forest Region, an irregular band 100-200 miles in width west of the Cumberland and Allegheny Plateaus, is marked by a transition from extensive mixed mesophytic communities in the east to extensive oak and oak-hickory communities in the west. The western mesophytic forest is less dense, has few dominants, and usually lacks the two indicator species of the mixed mesophytic forest (white basswood and yellow buckeye). Within this region, the lower Ohio River flood plain becomes a broad alluvial valley, which, at times, is only slightly lower than the rolling oak uplands.

Farther downstream, near Paducah, Kentucky, the Ohio River enters the northernmost extension of the Mississippi Alluvial Plain Section of the Southeastern Evergreen Forest Region. In this alluvial region, three subdivisions of bottomland forest are recognized: swamp forest, hardwood bottoms, and ridge bottoms. The swamp forest, consisting principally of cypress and tupelo gum, occupies land on which water stands throughout the year except during extreme droughts. The hardwood bottoms contain a

large number of species. These areas frequently overflow with water, and remain covered through the late winter and spring. Ridge bottoms contain some of the species of hardwood bottoms, but have a larger number of oaks and hickories. At slightly higher elevations than hardwood bottoms, these areas are covered by water only during floods.

The most extensive of the bottomland forests are the hardwood bottoms. In fact, the entire area has been classified as part of the "Southern Bottomland Hardwood Region." Braun has cited the following characteristic associations (in order of decreasing hydrophytism) within the bottomland hardwood forests in southern Illinois at the northern end of the Mississippi alluvial plain; a maple-pin oak-sweet gum forest, common between the sloughs and well-drained benches; a sweet gum-swamp white oak-pin oak forest in better drained parts of the bottom land, and a white oak-hickory-sweet gum forest, which occupies "ridge bottoms" and well-drained benches.

The ranges of at least 72 mammals overlap or closely adjoin the Ohio River mainstem and its defined operation and maintenance project area. These include at least 8 species of shrews, 3 species of moles, 15 species of bats, 9 species of squirrels, 8 species of mice, 4 species of voles, 6 other species of small mammals and 19 species of various furbearers and other mammals. Of these 72 species, the ranges of at least 45 overlap the upper Ohio River mainstem region within the Pittsburgh District, which extends from Mile 0.0 at Pittsburgh to Mile 127.2. Within the Huntington District, which extends from Mile 127.2 to Mile 438.0, and the Louisville District, which encompasses Mile 438.0 to Mile 981.0, at least 65 and 67 species of mammals, respectively, overlap the Ohio River mainstem region.

Many studies have been conducted on the avifauna of the Ohio River during the past 50 to 100 years. One such report lists the bird, its status, earliest and average arrival date, latest and average departure date, and a short statement about the species. During this period, man and time have brought about significant changes in the habitat along the Ohio River. The construction of locks and dams and periodic harvesting of forests have resulted in a change in the level of the river and in the types and diversity of habitats along the Ohio River Valley. A study of the avifauna in the upper Kanawha Valley illustrates this change by comparing the status of 112 species in 1872 with the status of the same species in 1972.

Two avian species which once flourished in the Ohio River Valley region, the passenger pigeon (*Ectopistes migratorius*) and the Carolina parakeet (*Conuropsis carolinensis*), are now extinct. Other species have been extirpated from the area and many more are showing population declines. It is evident that man's intervention and alteration of the habitat throughout the Ohio River Valley has had a marked effect upon its avian fauna.

The Ohio River Valley and its tributaries, however, continue to provide habitat for a diverse avian population. There are basically three major habitat types in the Ohio River region. The first of these is the floodplain forest. Along the Ohio River and its tributaries, floodplain forests may be subdivided into two basic types. In some cases the

forest is characterized by large trees with little understory, while in other instances the understory is a web of grapevines, virginia creeper, poison ivy, and other woody vines. The remaining two habitats may be classified as fallow fields and cropland, as well as upland forests. While numerous avian species are permanent residents of the Ohio River region, many other birds can be observed during the fall and spring as they migrate through the Atlantic and Mississippi Flyways.

Under the No Action alternative, little change is expected to occur to terrestrial resources. Habitats that have been converted from forests will likely remain in their current use with a few exceptions. Programs such as Conservation Reserve and some of the USFWS programs involving private lands may result in conversion of marginal agricultural lands to more beneficial wildlife habitat. However, some of these programs are for limited periods (e.g., 10 years) and would contribute to early successional habitats but not long-term objectives such as bottomland hardwood reforestation.

The two action alternatives would be expected to compliment existing programs by converting up to 25,000 acres of bottomlands from existing habitats (primarily agricultural) to hardwood forests. This would not only improve habitat quality, but would also help reduce fragmentation and would provide protective corridors required by many species. Bottomland hardwood forests would also help flood attenuation and would serve as sediment, nutrient, and contaminant sinks, thereby improving water quality. Many species of fish and wildlife would benefit directly from such habitat conversion. Also, because there are numerous species of migratory birds that utilize the Ohio River floodplain for nesting, these species would benefit throughout the other parts of their ranges. Conversion of agricultural lands to bottomland hardwoods would have some impacts on agricultural activities by slightly reducing the acreage farmed. However, it is expected that most of the agricultural lands converted would be somewhat marginal for farming due to the frequency of flooding and the duration of soil saturation during the growing season. Because more projects are expected to be implemented under the Regionally Preferred Alternative, impacts to terrestrial resources are expected to be greater under that plan than under the Corps Preferred Alternative.

4.3.6.7 Land Use

There are approximately 5 million acres of floodplain located along the Ohio River and the lower reaches of its tributaries. Land use within the floodplain has been estimated to be approximately 48 percent for cropland and pasture, 39 percent in woodland cover and forest preserves and 13 percent occupied by urban development and improvements of public, commercial, and industrial enterprises, etc.

Current land use patterns would not be expected to change appreciably under any of the alternatives. Either of the program alternatives would alter some localized areas from agricultural to wildlife habitat type uses. These areas would also experience increased uses for recreation and education. However, the primary benefits would be their contribution to the overall ecology of the river corridor.

4.3.6.8 Air Quality

Air quality in the region is affected by predominant currents bringing in air from other regions, or airsheds, into the Ohio Valley. Similarly, air emissions occurring throughout the valley affect air quality in downwind airsheds. The quality of air in the region is highly variable from locale to locale, depending on area emissions, ambient air quality, etc. Air quality also varies seasonally as weather patterns differ throughout the year. While most of the Ohio Valley is classified as in attainment with air quality standards, some areas, particularly those more densely populated, are classified as non-attainment for certain pollutants.

None of the alternatives considered in this study would have an appreciable effect on air quality within or outside the region. Under either program alternative, there may be localized changes, particularly from reductions in particulates and hydrocarbons as a result of converting agricultural lands to forests. Also, establishment of permanent vegetation may have a slight impact on air quality through increased conversion of carbon dioxide to oxygen. However, these changes would be minor over such a large area as the Ohio River Valley. Individual projects considered under an ecosystem restoration program would require evaluation under Federal Conformity Rules of the Clean Air Act.

4.3.6.9 Cultural Resources

Early man relied heavily on the major stream valleys for movement since valleys generally offered the easiest route from one region to another. The availability of certain basic resources within the Ohio River Basin, such as abundant water, food, game, chert, and fertile farmland, attracted human settlement.

The States of Pennsylvania, Ohio, West Virginia, Kentucky, Indiana, and Illinois have collectively recorded a total number of 2,212 archaeological sites within 1 kilometer of the Ohio River and its major slackwater areas. This figure is believed to represent approximately 5 percent of the total archaeological sites located along the Ohio River.

Nine of the 2,212 recorded sites along the banks of the Ohio River are included on the National Register of Historic Places and 21 have been determined eligible for inclusion. An additional 97 sites are potentially eligible for inclusion. Most of the remaining sites have not been tested or evaluated in terms of National Register criteria.

The types of sites that have been recorded include open campsites, village sites, mounds, cemeteries, shell heaps, rock shelters, hamlets, earthworks, petroglyphs, and quarry sites. The prehistoric inhabitants of these sites have been divided by archaeologists into four traditions based mainly on subsistence and technology. These traditions include Paleo-Indian, Archaic, Woodland, and Late Prehistoric.

Paleo-Indian Tradition (15,000 BC - 8,500 BC) Our knowledge of the earliest inhabitants in the Ohio Valley is limited to one rock shelter and surface finds of fluted projectile points. The single known excavated site dating to this period, the Meadowcroft Rockshelter located in western Pennsylvania, has produced stone tools radiocarbon dated to ca. 15,000, BC. These tools include an unfluted lanceolate projectile point, flake knives, flake blades, and retouched flakes. Fluted projectile points were manufactured by the Clovis culture from 10,500 BC to 8,500 BC.

Thirty-three recorded archaeological sites along the Ohio River, can be classified as having Paleo-Indian components. The Paleo-Indian occupation of the Ohio Valley coincided with terminal stages of the Pleistocene. The cultural pattern during this period is generally believed to be characterized by low population densities and a highly mobile settlement pattern with a subsistence oriented toward the hunting of large, now-extinct mammals in a tundra type environment. There was a preference for high grade cherts from distant quarry sites. The Paleo-Indian tradition was uniform throughout the Ohio Valley until the Late Paleo-Indian Period when regional differences in projectile point styles occurred.

Archaic Tradition (8500 BC – 1000 BC) In the Ohio Valley, the Archaic tradition apparently evolved out of the Paleo-Indian tradition. The Archaic tradition represents a readjustment to new environmental conditions brought on by the retreat of glacial ice and the extinction of a wide range of late Pleistocene fauna. Archaic populations gradually adapted to a deciduous forest environment. They appear to have been substantially larger, and groups of hunter-collectors became less mobile. There was a shift from high-grade chert to utilization of local low quality chert. They hunted deer and small mammals, fished, and gathered wild plants.

Throughout the Archaic Period there were changes in projectile point styles and introduction of new artifacts. During the Middle Archaic Period, grooved axes of ground stone were introduced for heavy woodworking. During the Late Archaic Period, steatite and sandstone bowls were introduced before the introduction of pottery during the Early Woodland Period. There was much regional diversity during the Late Archaic Period and populations can be characterized as having a "harvesting" economy with seasonal hunting activities. The importance of nuts and other plant foods was evident in the presence of nutting stones, mortars, and pestles. Non-utilization objects, large spear points, bannerstones, and stone, bone and shell ornaments are found with human burials in settlements and shell mounds. Dog ceremonialism is evident from dog burials. Marine shell, copper, and high quality chert were traded.

Woodland Tradition (1000 BC - 1000 AD) The introduction of pottery and horticulture marks the beginning of the Woodland Tradition. Gourds, squash, pumpkins, and sunflowers were cultivated. The Adena culture of this period constructed conical burial mounds of earth and stone. Burial artifacts included copper beads, bracelets, slate gorgets, and projectile points. The celt replaced the grooved Axe as the heavy-duty woodworking tool.

During the Middle Woodland Period the Hopewell culture attained its zenith in southern Ohio. The Hopewell constructed elaborate earthworks in the shapes of circles, squares, rectangles, and octagons. These earthworks, generally located on flat river bottoms, ranged in size from a few to several hundred acres. Associated with these ceremonial centers were burial mounds similar to those built by the preceding Adena people. Grave offerings included effigy platform pipes, sheet copper, obsidian, and mica. Trade items found on Hopewell sites in the Ohio Valley included grizzly bear teeth from the Rocky Mountains, galena from Illinois and Missouri, and conch shells from the Gulf Coast.

The Late Woodland Period is characterized by a cultural decline indicated by reduced mound buildings and an end of the elaborate trade networks. There was regional variation in the Late Woodland Period with a diversity of projectile points and pottery throughout the Ohio Valley. This cultural decline is attributed by some archaeologists to a slightly cool climate that may have affected agricultural production.

Late Prehistoric (1000 AD - Historic Contact) The Late Prehistoric tradition adapted to a present-day climate, development of intensive corn agriculture, planned village life, and the introduction of the bow and arrow. Shell tempered pottery and triangular arrow points were predominant throughout the Ohio Valley. There appears to have been a significant population increase accompanied by warfare throughout the Ohio Valley.

The Lower Ohio Valley was occupied by Mississippian people who built large truncated mounds topped with ceremonial buildings. Fortified villages with bastions and palisades made of logs covered with clay daub were built around these temple mounds. Houses were rectangular with log foundations, wall trenches, and thatched roofs. The settlement pattern also included small farmsteads and hamlets on the floodplains and terraces outside major village sites.

The Mid-Ohio Valley was occupied by the Fort Ancient people who lived in circular stockaded villages. The village plan consisted of one or two rows of rectangular or circular houses distributed inside a circular stockade wall. The center of the village was an open plaza, which was kept free of debris, presumably for ceremonial purposes. Burials were placed in stone slab boxes or simply put in storage or refuse pits inside or near the houses.

The Upper Ohio Valley was occupied by the Monongahela people who also lived in circular stockaded villages. The village plan consisted of one row of circular houses distributed inside a circular stockade wall with an open central plaza. Burials were placed in storage and refuse pits both inside and outside the house walls. The settlement pattern included villages on the floodplain, as well as upland villages located along major Indian trails.

The No Action alternative would result in little change to activities affecting cultural resources. Unregulated ground disturbing actions would continue and sites would continue to be disturbed or lost.

Both program alternatives could potentially affect cultural resources, particularly archeological sites, through ground disturbing activities such as constructing water management structures for hydrologic modification. However, under the program alternatives, these actions would be considered Federal undertakings for purposes of compliance with Section 106 of the National Historic Preservation Act. As such, regulatory compliance with Section 106 would require that impacts to historic properties be considered. Likely outcomes from that process would be identification of previously unknown sites, testing of sites prior to disturbance, avoidance of some sites, and data recovery from other sites. Overall, cultural resources would be better protected and/or data preserved than under the No Action alternative. Because more projects are expected to be implemented under the Regionally Preferred Alternative, impacts to cultural resources are expected to be greater under that plan than under the Corps Preferred Alternative.

4.3.6.10 Recreation

Recreation includes a wide diversity of activities along the Ohio River corridor. Water-based recreation includes boating, fishing, skiing, and sightseeing. Land-based activities include hunting, camping, wildlife viewing, hiking, and picnicking.

Under the No Action alternative some changes to existing recreation opportunities or activities could be anticipated. Examples would be increases in boating, fishing, etc., as water quality improves. Either of the program alternatives should improve recreation opportunities. In accordance with current Corps policy, ecosystem projects may include recreation features not to exceed 10 percent of project costs, as long as the features do not interfere with the primary purpose of ecosystem restoration. Improved populations of fish and wildlife should also improve recreational pursuits such as fishing, hunting, and wildlife viewing. Because more projects are expected to be implemented under the Regionally Preferred Alternative, impacts to recreation are expected to be greater under that plan than under the Corps Preferred Alternative.

4.3.6.11 Socioeconomics

Human activities, (economic, social, and cultural) have important impacts upon the environment. The area surrounding the Ohio River Valley affects the well being of the inhabitants of the six-state area through which it flows. There are seven standard metropolitan statistical areas (SMSAs) along the main stem of the Ohio River. These

areas support some 8 million people and their industrial, agricultural, commercial, and recreational pursuits.

Socioeconomics would not be significantly affected by any of the alternatives. While conversion of land uses from agricultural to environmental could reduce income in some cases, it is expected that many of these conversions would be of marginal farming lands. Implementation of either ecological restoration alternative could improve general “quality of life” factors for the overall population. Although this could result in economic benefits, such benefits are incidental to the ecological benefits that are the primary program purpose. With regard to Environmental Justice considerations, there is no indication that potential project areas are disproportionately inhabited by minority or low income populations. Individual projects under a program would be subject to Environmental Justice considerations during project planning.

4.3.6.12 Aesthetics

Aesthetic values are subjective according to individual perception. Aesthetics along most of the river corridor would be considered appealing with the mix of land uses and natural features to view.

The No Action alternative would not be expected to affect aesthetics along the river corridor. For those that appreciate natural settings, either program alternative should result in improvement of aesthetic values except during project construction. It is possible that some project features (e.g., riprap or chevron dikes) may detract from the natural setting.

4.3.6.13 Noise

Ambient noise levels along the river corridor are not expected to change appreciably under any of the alternatives except during periods of construction.

4.3.6.14 Hazardous, Toxic, and Radiological Wastes

The No Action alternative is not expected to affect presence of these wastes. Projects implemented under either program alternative would not be located in areas contaminated by Hazardous, Toxic, and Radioactive wastes.

4.3.6.15 Unresolved Conflicts

There are no unresolved conflicts.

4.3.6.16 Mitigation

Under either of the program alternatives it is expected that few adverse environmental impacts would occur. Because the purpose of an ecosystem restoration program would be to restore natural resources and processes, no compensatory mitigation is anticipated. However, within the context of compliance with the National Environmental Policy Act and other environmental requirements, mitigation considerations would be further examined during site-specific project evaluations. Typical measures to avoid, lessen, and compensate for environmental impacts are shown in Table 4-2 below.

TABLE 4-2

Measures to Avoid, Lessen, Mitigate, or Compensate for Environmental Impacts.

IMPACT	MEASURES
Erosion from disturbed sites during construction.	Require development of Environmental Protection Plans incorporating Best Management Practices to control soil loss. Compliance with NPDES storm water permits for sites over 5 acres.
Impacts to fish spawning.	Avoid in-water construction during fish spawning periods.
Sediment Resuspension	Perform dredging activities during low-flow periods. Deploy silt containment devices as needed.
Loss of Archeological sites.	Complete Section 106 compliance process for each individual project, including survey, testing, and data recovery as necessary.
Impacts to Listed Species.	Coordination and Consultation with the USFWS to fully consider ESA concerns and measures to minimize impacts.
Site-specific Impacts	Analyses of impacts and development of NEPA documents to evaluate and consider impacts of individual actions. Site-specific measures to avoid and/or minimize impacts would be included.

4.4 TRADE-OFF ANALYSIS

Without a comprehensive ecosystem restoration program for the Ohio River corridor, no systematic, strategic mechanism would exist to integrate new initiatives with existing authorities. The result would be a continuation of piece-meal projects targeting individual environmental resources without an over-arching view of the river and its floodplain as an integrated ecosystem. A relatively small number of Corps of Engineers projects under Sections 1135 and 206 are likely to be implemented, as evidenced by the few projects in place so far.

Implementation of an ecosystem restoration authority for the Ohio River corridor would necessitate taking a holistic view of the integrated system in developing and prioritizing among individual projects to ensure each contributes to the objectives of the program. Each of the program alternatives has its advantages and disadvantages. The recommended program would be consistent with existing law and policy for ecosystem restoration programs. It should, therefore, be supported in annual budget requests. However, it does not offer a better arrangement for cost sharing or credit for work-in-kind than existing programs. Therefore, non-Federal sponsors are likely to participate in fewer projects due to limitations on their resources. The regionally preferred program offers better arrangements to non-federal sponsors, but federal money for the program may not be included in annual budget requests. This could result in lack of a stable, predictable funding base needed to implement a long-term comprehensive program.

With regard to environmental impacts, the purpose of a proposed program under either alternative would be to produce positive environmental benefits. The benefits of neither program alternative clearly outweighs those of the other. However, the alternative that would result in implementation of the greater number of projects should also result in more positive environmental benefits.

Considering the advantages and disadvantages among the three alternatives, it appears that the preferred alternative (i.e., consistent with current ecosystem law and policy) has a slight edge over the regionally preferred alternative. Both program alternatives offer advantages over the No Action alternative.

4.5 SELECTION OF THE FINAL PLAN

The Recommended Program alternative would include cost sharing at 65% Federal and 35% non-Federal. The program would be fully compliant with current law and policy for ecosystem restoration. The program would facilitate formation of a partnership among the Federal and non-federal agencies. Under this alternative, a comprehensive plan for ecosystem restoration for the Ohio River would be developed. The existence of an authorized program with a comprehensive plan in place should make

planning and budgeting for future projects easier for all parties. Therefore, the Recommended Program alternative would help ensure that projects are developed in a framework that meets the criteria of completeness, efficiency, effectiveness, and acceptability. This plan would still have risks associated with finding partners to participate in the program.

DESCRIPTION OF RECOMMENDED ALTERNATIVE

5.1 COMPONENTS OF THE RECOMMENDED ALTERNATIVE

The tentatively recommended Ecosystem Restoration Alternative consists of the following components:

1. Projects implemented under this program would be cost shared. The Federal cost under the program would have a cost of 65% of the total implementation cost. The non-Federal share would be 35% of the total implementation of a project.
2. The non-Federal sponsor would be required to provide all lands, easements, right-of-ways, relocations, and disposal sites (LERRDS) for the project. When LERRDS are expected to exceed 35% of the total project cost, the non-Federal sponsor would be reimbursed for the additional LERRDS. The Government may, at its option, assume financial responsibility for payment of the portion of the LERRD's that exceeds 35 percent of the total project cost.
3. Funds from another Federal agency may be used as the non-Federal share of Corps projects when the other Federal agency certifies in writing that the use of such funds for that purpose is authorized.
4. The non-Federal sponsor would be responsible for operation, maintenance, repairs, rehabilitation, and replacement (OMRR&R) of the individual project once it is completed. The Districts would prepare O&M manuals in accordance with ER 1105-2-401.
5. For projects on Corps lands, a non-Federal sponsor would be responsible for cost-sharing and OMRR&R. Specific projects would be monitored on a case-by-case where there is uncertainty that the project would function as designed. Monitoring is part of project implementation and would be a basis for "lessons learned" to be applied to the future projects.
6. The Corps and its environmental partners would update and refine the stated opportunities of the program during preparation of the Program Implementation Plan (PIP). A long-term habitat needs assessment may be required in the future. There is no existing authority for a fully Federally

funded assessment. A major portion of this type of evaluation would normally be part of a feasibility study and cost-shared in accordance with ER1105-2-100, Chapter 2, Paragraph 2-8c.

7. A non-Federal sponsor would be responsible for cost sharing projects to be implemented at Federal facilities such as locks, dams and power plants that are operated and maintained by the Corps of Engineers and not leased to another agency, group, or individual. For such projects, the Corps may assume responsibility for the cost and performance of OMRR&R, however specific approval would be required from the Division Commander when OMM&R costs are expected to exceed \$5,000 annually.
8. Following completion of the specific projects, the Corps would periodically inspect projects.
9. A program implementation report would be prepared in the first year of the program and a comprehensive strategic plan would be included as part of that report. Where other lands of other Federal agencies would be used for a restoration project, e.g., Department of Interior or Department of Agriculture lands, the Corps would not use Civil Works funds to implement a project. The non-Federal sponsor would be responsible for coordinating implementation and OMRR&R with the hosting Federal agency.
10. The program would be authorized with maximum Federal Funding of \$10 million annually for each of the first 5 years and \$15 million annually, thereafter.
11. The 1 percent for monitoring and the 3 percent adaptive management funds would be included in the total costs of Project Implementation Report (PIR).

Because the primary purpose of any projects implemented under the proposed program would be to improve ecosystem conditions over the long-term, no compensatory mitigation should be needed.

5.2. DESIGN AND CONSTRUCTION CONSIDERATIONS

Ecosystem restoration projects investigated under this program would be subject to the Corps of Engineers' normal quality assurance/quality control processes to include independent technical review, legal review, and Ohio River and Great Lakes Division policy compliance review. Authorization of the Ohio River Ecosystem Restoration Program would not involve specific authorization of any projects. Example projects used in this report still require completion of a site specific feasibility level study resulting in a Project Implementation Report (PIR). Procedures and requirements for developing specific projects for implementation would include the following: a. Description of problem and opportunities, b. Evaluation of benefits, costs, and impacts, c. Preparation of a feasibility level decision document, d. Demonstrated compliance with appropriate environmental (e.g., National Environmental Policy Act) laws and statutes, e. Public

review of the draft PIR, and f. Review and approval of the specific project by appropriate authority within the Corps of Engineers.

5.2.1 Pre-Feasibility Phase Preparation of Preliminary Restoration Plan (PRP)

The PRP would be a brief reconnaissance document describing the proposed project, the ecosystem to be restored, the outputs to be produced, the cost of the project, and a rationale as to why the value of the outputs is judged to be at least commensurate with the cost of obtaining them. Also included would be a map(s) of the project location and a letter of intent from the non-Federal sponsor. The PRP would be forwarded to the Division Engineer to serve as the basis for approval of allocation of feasibility study funds.

5.2.2 Feasibility Phase

A feasibility level study would be completed for each proposed project under the Ohio River Corridor Ecosystem Restoration program as described in the following sections. The report of feasibility level studies would be a Project Implementation Report (PIR). The feasibility phase would typically cost about 20% of the total first costs of the proposed project.

5.2.2.1 Criteria for Alternative Selection

Plans developed for individual projects to be recommended would be consistent with cost effectiveness principles and the analytical framework established by the Principles and Guidelines (P&G) adopted by the Water Resources Council. Ecosystem restoration studies differ from studies focused on traditional study purposes only in that the benefit evaluation will focus on quantitative and qualitative restoration outputs and monetary benefits are usually incidental. Individual ecosystem restoration plans would be formulated and evaluated in terms of their net contributions to increases in ecosystem value (NER outputs), expressed in non-monetary units. Incremental cost analysis consistent with Institute for Water Resources methods would be used to evaluate alternatives and determine the cost effectiveness of each project in the proposed Ohio River Ecosystem Restoration Program. In addition to the amount of restoration that has been adopted as objectives of the program, individual projects implemented within the program would be required to meet all criteria described in ER 1105-2-100. This includes addressing the following during formulation and evaluation of alternative plans:

- Enhancing national economic development (including benefits to particular regions that are not transfers from other regions)
- Protecting and restoring the quality of the total environment
- The well-being of the people of the United States
- The prevention of the loss of life
- The preservation of cultural and historical values

Evaluation of individual projects under the proposed program would consist of four tasks. The first task would be to forecast the most likely with-project condition expected under each alternative plan. The second task would be to compare each with-project condition to the without project condition and document the differences. The third task would be to characterize the beneficial and adverse effects by magnitude, location, timing, and duration. The fourth task would be to identify plans for further consideration in the planning process. As described in ER 1105-2-100, four accounts are established to facilitate evaluation and display of effects of alternative plans. Display of these accounts in the feasibility study of individual projects is required. They include the following:

- The national economic development account displays changes in the economic value of the national output of goods and services.
- The environmental quality account displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of ecosystem restoration plans.
- The regional economic development account displays changes in distribution of regional economic activity (e.g., income and employment).
- The other social effects account displays plan effects on social aspects such as community impacts, health and safety, displacement, energy conservation and others.

Projects under the proposed program may deviate from the national Economic Development Plan and/or the National Ecosystem Restoration Plan if requested by the non-federal sponsor and approved by ASA(CW). In some instances, a sponsor under this proposed program may not be able to afford or otherwise support the NED, NER, or combined NED/NER Plan. Plans requested by the non-Federal sponsor that deviate from the NED and/or NER plans shall be identified as the regionally preferred plan (RPP). When the RPP is clearly of less scope and cost and meets the Administration's policies for high priority outputs, an exception is usually granted by ASA(CW). If the sponsor prefers a plan more costly than the NED, NER, or NED/NER Plan and the increased scope of the plan is not sufficient to warrant full Federal participation, ASA(CW) may grant an exception as long as the sponsor pays the difference between those plans and the locally preferred plan. Plans considered under the proposed ecosystem restoration program for the Ohio River would include a description of the risks and uncertainty associated with the plan so that decisions can be based on the best available information. Risk based analysis would be used to compare plans in terms of the likelihood and variability of their physical performance, economic success, and residual risks. Individual

projects implemented within the context of the restoration program would be required to meet the following criteria as described in ER 1105-2-100:

- Completeness of individual projects
- Cost effectiveness of individual projects
- Economic feasibility of individual projects
- Environmental acceptability of projects
- Institutionally acceptable
- Public acceptability
- Non-Federal sponsorship of individual projects

5.2.3 Project Plan Formulation

5.2.3.1 Alternatives

During the feasibility study phase of each project, alternatives to address the objectives of the ecosystem restoration effort would be formulated and evaluated considering the following topics.

5.2.3.2 Costs and Benefits

Both costs and benefits for individual projects would be estimated as part of the feasibility study process under the proposed Program for the Ohio River. Plans to address ecosystem restoration would be formulated in accordance with ER 1105-2-100, Planning Guidance Notebook. The projects would be consistent with cost effectiveness principles. The projects would be justified by non-monetary ecological benefits.

5.2.3.3 Incremental Analysis

As required by ER 1105-2-100, an incremental analysis of alternatives for each project would be completed in the Feasibility phase of project development. Information on incremental analysis can be found on Page 3-26 of ER 1105-2-100. Examples of incremental analysis are shown in Appendix H for the five typical projects.

5.2.3.4 National Environmental Policy Act Compliance

Ecosystem restoration projects under the proposed Ohio River Ecosystem Restoration Program would be required to be in compliance with all applicable Federal environmental statutes and regulations as well as any state and local requirements. Laws and Policies to be followed include Section 404 (Clean Water Act) is described in ER

1105-2-100. NEPA and other compliance requirements would be fulfilled during the feasibility stage of project development and would be in compliance with ER 200-2-2 and other applicable regulations. Verification that each recommended project is compliant with the laws and policies would be included in the IR and associated NEPA document.

5.2.3.5 Navigation Considerations

The Ohio River is a navigable stream and has a series of locks and dams extending from Pittsburgh, Pennsylvania to the Mississippi River. During formulation and evaluation of ecosystem restoration plans it would be necessary to ensure proposed projects do not adversely impact navigation. Authorization of the proposed ecosystem restoration program for the Ohio River would not preclude implementation of any ecosystem restoration projects mentioned in this report under another applicable program or authority. For example, any of the 250 projects identified in this study to date could be considered in the future for mitigation for navigation improvement impacts. Also, any of the projects that meet current policy could be implemented under existing Corps authorities. If a project was determined to be suitable mitigation for navigation or other impacts, that project would no longer be considered under the proposed ecosystem restoration program.

5.2.3.6 Hydrology Considerations

During the feasibility phase of projects involving the construction of dikes, revetments, or other such fill activities, hydrologists would perform an engineering analysis to assure the proposed features would not cause detrimental localized flooding, adverse currents for navigation traffic, or bank scour. The proposed construction activities shall conform to all Federal, state and local laws and regulations pertaining to floodplain management.

5.2.3.7 Real Estate Considerations

A new Ecosystem Restoration Program for the Ohio River would be consistent with current law and policy. Therefore, projects involving land acquisition costs exceeding 25 percent of the total project implementation costs would not be expected to receive high priority under a new Ecosystem Restoration Program. Baseline real estate costs for each of the five example projects are included in the draft baseline estimates in Appendix H. The non-Federal sponsor would be required to provide all LERRDS for each project in the proposed program and must possess the legal authority and financial capability to do so. Real Estate considerations for this program would follow the guidelines in ER1165-2-501, paragraph 17.

5.2.3.8 Recreation Considerations

In accordance with current policy, ecosystem restoration projects under the proposed Ecosystem Restoration Program that have recreation features included may be considered during the development of specific projects for implementation. Any recreation features must be in compliance with current Corps policy (Appendix B of EP 1165-2-502) and not exceed 10% of the total project cost. Recreation development at ecosystem restoration projects should not require additional lands. Recreation facilities may be added to take advantage of the education and recreation potential of the ecosystem project if the separable costs of such facilities are justifiable by the recreation opportunities.

5.2.4 Pre-Construction Engineering Design Phase

Following completion of the PIR (feasibility phase), projects would be approved for Pre-construction Engineering Design (PED) phase. PED and the feasibility report may be combined for projects with a total cost of \$500,000 or less. In addition to producing detailed designs, plans and specifications for advertising for construction, and MCACES cost estimates, the Corps and the non-Federal sponsor would be required to execute a Project Cooperation Agreement (PCA). It is assumed that a model PCA would be developed similar to current models for other environmental programs. By executing a PCA, the sponsor would be required to agree with the following required items of local cooperation:

5.2.4.1 Required Items of Local Cooperation

In considering any project as part of the proposed Ecosystem Restoration Program the following items of local cooperation would be required:

a. Provide 35 percent of the separable project costs allocated to environmental restoration and 50 percent of the separate project costs allocated to recreation, as further specified below:

- (1) Enter into an agreement which provides, prior to execution of a project cooperation agreement for the project, 35 percent of design costs;
- (2) Provide, during construction, any additional funds needed to cover the non-Federal share of design costs;
- (3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

- (4) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and
- (5) Provide, during construction, any additional costs as necessary to make its total contribution equal to 35 percent of the separable project costs allocated to environmental restoration and 50 percent of the separable project costs allocated to recreation.

b. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate (OMRR&R) the completed project, or functional portion of the project, including mitigation features, at no cost to the Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and any specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

c. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

d. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising during the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs. These documents would be made available for public inspection at reasonable times during normal business hours.

g. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on

lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, and/or maintenance of the project.

i. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project and otherwise perform its obligations in a manner that will not cause liability to arise under CERCLA.

j. Prevent future encroachments on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project.

k. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

m. Provide the non-Federal share of that portion of total cultural resource preservation mitigation and data recovery costs attributable to environmental restoration and recreation that are in excess of one percent of the total amount authorized to be appropriated for environmental restoration and recreation.

n. Not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

o. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms.

5.2.4.2 Other Permits and Certification

The non-Federal sponsor would also be required to obtain any state or local permits in the PED Phase. Quality control (QC) and Quality Assurance (QA) are integral to

restoration project development. To ensure compliance of each project with all technical and policy requirements, a QC plan would be prepared by the district, with division oversight provided through the QA program. Technical reviews would be completed and documented at each phase of project development.

5.2.5 Project Execution Phase

5.2.5.1 Real Estate Acquisition

The non-Federal sponsor under this program would acquire the real estate for each project. The District's Real Estate Division would be responsible for reviewing and certifying that real estate is available prior to construction. Real estate acquisition would be completed in accordance with all Real Estate regulations that apply to Corps ecosystem restoration projects under the Corps' Continuing Authorities.

5.2.5.2 Construction

The Corps of Engineers, using contractors based on current procurement procedures, would complete construction of most individual projects. The Corps of Engineers would be responsible for administering and managing the contract.

5.3 OPERATION AND MAINTENANCE

5.3.1 Operation and Maintenance

Following construction of a project under this recommended program, the project would be turned over to the non-Federal sponsor for operation and maintenance. The sponsor would also be responsible for any repair, replacement, and rehabilitation work in the future beyond the normal operation and maintenance. The Corps would inspect the project periodically to assure proper maintenance is being formed. If the project is not maintained, the Corps of Engineers would complete maintenance and bill the non-Federal sponsor as described in the Project Cooperation Agreement (PCA) executed between the Corps of Engineers and the non-Federal sponsor prior to construction.

5.3.2 Post-Construction Monitoring

Monitoring of the ecosystem restoration project may be warranted in some cases, especially when the risk of uncertainty of achieving the projected outputs is high. Monitoring would be limited to a 3 to 5 year period for those projects and would not exceed 1% of the total first cost of the ecosystem restoration features. Monitoring is part of the project implementation. When implemented, monitoring would provide a basis for any decision to modify the project (i.e., adaptive management) and would serve as a “lessons learned” resource for future projects.

5.4 PLAN ACCOMPLISHMENTS

5.4.1 Typical Projects Included in the Ecosystem Restoration Program

Appendix H includes details of five specific restoration projects that are representative of the types of projects that are envisioned under the proposed Ohio River Ecosystem Restoration Program. Also shown is a summary sheet of costs for the five projects, including real estate costs and Corps planning, engineering, and administrative costs. Those five projects are:

- 1. Barren Creek and Big Bay Creek Embayments (IL-09/10)**
- 2. Hovey Lake Restoration (IN-10/11)**
- 3. Lewis County Kentucky Bottomland Restoration (KY-31)**
- 4. Upper Twin Creek T-Dikes (OH-06)**
- 5. Hannibal Dam Tail Waters Revetments (WV-40)**

At the beginning of the study the natural resource agencies of states bordering the Ohio River identified over 250 possible project sites for inclusion in a specifically authorized Ohio River Ecosystem Restoration Program. The letters/numbers at the end of each project are project identification codes assigned during the study. All of the 250 project sites are located along the mainstem corridor. Future non-Federal sponsors, such as cities, counties and large conservation groups, would likely identify other possible project sites. Seventy-four possible project sites were initially investigated by the Corps of Engineers. Evaluation of those sites helped to estimate the range of costs and benefits to be expected for various typical ecosystem restoration projects. For any of these projects, additional, feasibility level study would be necessary prior to having a specific project approved for implementation. Sufficient detail is presented in this report to

describe, characterize and evaluate what an Ohio River Restoration Program could be, what it would accomplish, and what it would cost.

Fully implemented, the proposed program would:

- restore 25,000 acres of bottomland hardwood forests,
- improve 1,250 acres of aquatic habitat,
- restore/protect 40 islands,
- improve 100 miles of shoreline/riparian habitat, and
- restore 25,000 acres of wetlands.

5.5 SUMMARY OF ECONOMIC, ENVIRONMENTAL AND OTHER SOCIAL EFFECTS

One of the major benefits of an ecosystem restoration program on the Ohio River would be the comprehensive and cooperative ability by many partners to focus on the Ohio River ecosystem and to effectively and collectively plan. One of the initial components under the Ohio River Corridor Ecosystem Restoration Program would be development of a strategic Program Implementation Plan (PIP) to evaluate and prioritize restoration efforts within resource constraints of participating groups. Through a coordinated partnership among agencies, Federal and non-Federal sponsors, environmental groups, academia, and interested users of the Ohio River and private entities, a synergy would be created to better optimize available resources. Such a program plan would be significant improvement over the fragmented approach currently in effect through the various agencies, groups and individuals. Because the preferred program is for primarily ecosystem restoration, the benefits are not measurable as economic benefits. There would not be a significant economic benefits that could be applied to the National Economic Development Account. Federal costs for the program if fully implemented would be in the range of \$200 million. The environmental effects of the preferred program would primarily be positive in nature. There would be some temporary impacts during construction of specific projects. At this time it is not expected that there would be much compensatory mitigation. Overall the net environmental effects would be very positive. Social effects of this preferred program would be positive. Many communities are trying to reconnect with the Ohio River environment. Education and awareness of the environment is making environmental planning very important. This preferred program would contribute to the social well being of an important part of the nation. Regional economic costs would be up to \$108 million (i.e., the non-federal cost-share). As this is an environmental program, benefits would primarily be non-monetary.

PROGRAM IMPLEMENTATION

6.1 PROGRAM IMPLEMENTATION

During the initial year of the program authorization, the Corps of Engineers, in consultation with the U.S. Fish and Wildlife Service, Environmental Protection Agency, Ohio River Valley Water Sanitation Commission (ORSANCO), state natural resource agencies, and other regional environmental interest groups, would develop a strategic Program Implementation Plan (PIP). The PIP would evaluate and prioritize restoration efforts in consideration of available resources. This plan would refine program goals, identify and prioritize specific ecosystem needs, define procedures for data collection and dissemination, and establish evaluation and management plans for implementation of site specific ecosystem restoration projects. Prioritization of specific projects would be based upon ecological considerations. The PIP would be approved by the interagency partnership prior to final approval at the Washington level.

The PIP would also include a detailed description of all existing specialized programs, such as the U.S. Department of Agriculture's Wetland Reserve and Conservation Reserve programs, which may be used for implementation of certain projects in lieu of the broader Ohio River Ecosystem Restoration Program. The Corps of Engineers and its environmental partners would use that information to advise non-Federal sponsors regarding the most cost effective and technically appropriate program for implementation of their projects.

After approval of the PIP, the Corps of Engineers and its partners would gather and centrally organize existing data on water quality, fish, invertebrates, reptiles, waterfowl, vegetation, sedimentation, water levels and flows, aerial photography, satellite imagery, scientific publications and similar ecological records. These data, to be obtained from organizations including resource agencies, universities, and conservation groups, would be accessible through the Internet and other media to the extent allowable for protection of sensitive information. After the partners identify any significant gaps in the existing database, studies and surveys would be conducted to narrow these gaps. None of these studies or surveys would require more than two growing seasons to complete. This database would serve as the benchmark conditions against which program success would be measured. These data would also allow the partnership to evaluate the ecological needs of the river in relationship to the established objectives and goals of the Ohio River ecosystem restoration program. The partnership would identify and prioritize its list of

proposed site-specific projects based upon ecosystem needs, not fiscal parameters. Projects would then be implemented based upon prioritization, available funding of non-Federal sponsors, and final approval by the Corps of Engineers. This process would be repeated during the eighth year of the program, so the partners may reassess program success and ecological needs, update the database, and reprioritize the sequence of specific project implementation as appropriate. A final program assessment would be conducted in the fourteenth year to document the effects of the program. The requirements for funding, study, design and implementation of ecosystem restoration projects are described in Section 5.

During the first three years following program authorization, an estimated \$1 million in Federal funding would be used for preparation of the PIP, building and organizing Geographic Information System (GIS) databases, and information management. Each resource agency and organization within the partnership would fund their respective labor expenses and travel costs for participation in the data collection, evaluation, and management efforts. Funds for program implementation would be included within the annual Federal funding for implementation of the program. These funds would be available during the first three budget years of the authorized program. The assessments in the eighth and fourteenth years would require approximately \$700,000 each. Funding for the initial program implementation and later reassessment efforts would total less than 1-1/4 percent of the \$200 million recommended program authorized Federal limit.

Among the first tasks of the interagency partners would be to sign a Memorandum of Agreement (MOA) that establishes the responsibilities of each partner. The MOA would describe the responsibility of each partner relative to central data base contributions, distribution of study costs for benchmark and the two subsequent assessments, and the anticipated annual in-kind services credits. The draft MOA will be submitted to Headquarters for Washington-level review and approval prior to execution with partners.

Each year the Corps of Engineers would convene a meeting of fishery and wildlife biologists, and ecologists from the Corps, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Ohio River Valley Water Sanitation Commission (ORSANCO), state natural resource agencies, and other regional environmental interest groups to evaluate the merit and sequencing of projects proposed for the near future. Based on the program master plan and the brief requests submitted to the respective Corps District offices, the Team would prepare a short report outlining which specific projects should be implemented during the coming fiscal year based on ecosystem benefits. The report would also provide an analysis of what projects are most likely to be implementable based on the non-Federal sponsors' ability to fund the individual projects. The report would be presented to the Division Engineer who would accept the Team recommendations as submitted, or amend it with an explanation to the Team for the changes. The approved projects would then be funded to advance to the feasibility study

phase (including NEPA documentation), and/or implementation, whichever is appropriate.

All site-specific projects would be implemented in accordance with the study and funding requirements of existing ecosystem restoration authorities. Generally, these projects would be conducted in the standard phases used for other Continuing Authority Programs; a brief request to initiate a feasibility phase study and NEPA documentation, a PED phase, and the construction phase. The up-front Federal financing of the site specific decision documents will provide gains in efficiency greater than the risks associated with construction costs.. Table 6-1 below describes cost sharing for the Ohio River Preferred Ecosystem Restoration Program.

Table 6.1 Ohio River Cost Sharing Policy

Document	Purpose	Cost Sharing Policy	Para. Ref.
PIP¹	General Plan	100% Federal Cost	6.1
PRP	Recon Rpt1	100% Federal Cost	5.2.1
PIR	Feasibility Rpt	100% Federal Financing²	5.2.2
PED	Contract Docs	100% Federal Financing²	5.2.4
PCA	Construction	65/35 (Fed/Non-Fed)	5.2.5

¹ Program Implementation Plan (PIP) is limited to 1.25 percent of the total program.

² Federal cost sharing recovered within the first year after signing of the site-specific PCA to meet the non-Federal 35 percent cost share.

6.2 NON-FEDERAL RESPONSIBILITIES

Program-level responsibilities of the non-Federal partners would include providing their existing water quality, biological, and habitat information for inclusion in the central database, and participation in studies and periodic program meetings. These services would be provided in lieu of cash contributions towards establishing and maintaining the central data base, preparing the PIP and benchmark studies, and the eighth and fourteenth year program assessments. According to the Corps recommended alternative, the first

costs of specific projects would be cost shared 65% Federal and 35% non-Federal. The non-Federal sponsor would be required to provide all LERRDs. The non-Federal sponsor would also be responsible for 100% of all OMRR&Rs. Paragraph 5.1 of Section 5 presents details of the proposed non-Federal responsibilities for specific projects.

6.3 VIEWS OF POTENTIAL NON-FEDERAL SPONSORS AND OTHER AGENCIES

Strong support for an Ohio River-specific ecosystem restoration program has been shown by the six river states. The natural resources agency of each state has actively participated in an interagency study team that established program goals and identified potential restoration project sites. Although the states strongly support the program, they have repeatedly and adamantly expressed concerns regarding the 65:35 cost-sharing ratio, credit for services, and projects on Federal lands. The senior executives of the natural resources management agency of four of the partnering states have provided letters (Appendix F) supporting the proposed program and stating their intentions to participate in the program if acceptable cost-sharing is authorized. ORSANCO has also provided a letter supporting the program (Appendix F) and the U.S. Fish and Wildlife Service has indicated support in the Draft Fish and Wildlife Coordination Report. The Regionally Preferred Alternative presented in paragraph 4.3.5 of Section 4 includes measures to address the concerns of the states and the USFWS.

SUMMARY OF COORDINATION, PUBLIC VIEWS AND COMMENTS

7.1 SCOPING MEETINGS

Ohio River Mainstem System Study (ORMSS) public workshops were held in November 1998 in three metropolitan areas representing the lower, middle and upper reaches of the Ohio River. Three nearly identical workshops took place from 12:00 noon to 8:00 p.m. within a one-week period. These meetings were held in Evansville, Indiana on November 17, 1998; in Huntington, WV on November 19; and in Pittsburgh, PA on November 24, 1998. There were two primary purposes for these workshops:

- To obtain input from the public-at-large on future needs for Ohio River navigation and for environmental restoration opportunities along the River; and
- To fulfill (partially) requirements of the National Environmental Policy Act which call for such public scoping meetings.

The purpose and schedules of the meetings were published in the Wednesday, October 21, 1998 Federal Register. In addition, a Public Notice, announcing the meetings, was mailed to approximately 3,200 recipients. Recipients included agencies, industries, and individuals. Public notices of the meetings were also published in the legal notices of several regional newspapers. A total of eighty individuals attended the three sessions (approximately 27 at each).

Each session consisted of an open display area with three display units -- (1) Plan Formulation, (2) Economics, and (3) Environmental issues. ORMSS team leaders manned each display unit to answer questions and discuss issues. Several comment letters were received in response to the Public Notices and meeting. Informative comments were obtained at all sessions, and were fully considered in preparation of this report.

7.2 INTERAGENCY COORDINATION

Soon after the public scoping meetings, the Corps of Engineers founded an interagency partnership to study the ecological needs and opportunities for the Ohio River corridor. As previously indicated, representatives of the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency and natural resource agencies of Illinois, Indiana, Kentucky, Ohio, West Virginia and Pennsylvania, were active participants in the study process. During numerous meetings, the interagency partnership and its three working groups identified ecosystem losses and established the goals and opportunities of the proposed Ohio River ecosystem restoration program. The findings and conclusions of the interagency partnership are described in Appendix A. The goals and opportunities of the proposed program are detailed in Section 3 of this report.

During the early months of the partnership, the Corps requested state natural resource agency officials to identify and prioritize potential site-specific ecosystem restoration projects along the Ohio River corridor. The states provided a list of over 250 projects. Approximately 70 of those projects were further studied to illustrate various ecosystem restoration practices and develop a range of project implementation costs. Further details regarding the process of identifying and developing the potential ecosystem restoration projects are provided in paragraph 3.5.1 of Section 3.

The Indiana Department of Natural Resources, Kentucky Fish and Wildlife, West Virginia Division of Natural Resources, Ohio Department of Natural Resources and Pennsylvania Fish and Boat Commission have submitted Letters of Intent to express intent for participation in an Ohio River ecosystem restoration program. These letters are provided in Appendix E of this report. The Ohio River Valley Water Sanitation Commission (ORSANCO) has also demonstrated support for the program in the form of a resolution passed at its 167th meeting on May 25, 2000. A copy of the resolution is contained in Appendix F.

7.3 FINAL DECISION DOCUMENT AND ENVIRONMENTAL ASSESSMENT COORDINATION & REVIEW

This draft study report – a Decision Document and Environmental Assessment -- was circulated for a 30-day public comment period in August 2000. During that period, various Federal and state agencies, environmental organizations, and the public were afforded the opportunity to review a draft of this report. The Pittsburgh, Huntington and Louisville Districts of the Corps of Engineers issued News Releases regarding the public comment period. Notices of Availability were also mailed to over 3200 recipients. The complete mailing list is included in Appendix E.

Following distribution of the Notice of Availability, copies of the report (either printed, or digital copies on CDROM-disk) were also distributed to the general public (on request). The digital versions of the documents were also available to download to personal computers via the Internet from the Louisville District Internet site.

As result of public review, 32 letters and e-mail messages were received. The comments are reproduced in Appendix E of this report. Numerous comments were received from both organizations and individuals. Generally the regional plan was favored because of some gaps that existing authorities do not address and the potential increase in number of projects that the states could complete with a different cost sharing formula than 65% Federal and 35% non-Federal shown in the preferred alternative. The preferred plan as presented in the draft Decision Document would limit states involvement because of funding and resource limitations. Responses to each of the comments are provided in Appendix E. A letter with responses has been provided to each organization or individual making the comments.

Some pages in this Final Decision Document and Environmental Assessment have been revised since the circulation of the draft report dated August 2000. These changes are a result of the Corps' Headquarters review of the report as well as the public and agency review.

Pages in the Main Report and in the Appendices that have been revised. Changes in the final report are generally marked "Revised September 2000" (or similarly) at the bottom of pages i.e., near the page number.

FINDINGS AND RECOMMENDATIONS

The recommended plan (Corps Preferred Alternative) is the Ecosystem Restoration Program for the Ohio River described in Section 4 and 5 of this report. Projects implemented under an Ecosystem Restoration program would be cost shared, 65% Federal cost and 35 % nonfederal cost. On a case-by-case basis, projects may be monitored as part of cost shared project, typically not to exceed five years and not to exceed 1% of project first costs.

The recommended plan would be authorized with the maximum Federal Funding of \$10 million annually for each of the first five years, and \$15 million annually for the remainder of the program.

As previously described in Sections 4 and 5 of this report, projects with land acquisition costs over 25% would be low priority.

The nonfederal sponsors would, prior to implementation, agree to perform the required items of cooperation. A listing of local cooperation requirements are as follows:

a. Provide 35 percent of the separable project costs allocated to environmental restoration and 50 percent of the separate project costs allocated to recreation, as further specified below:

- (1) Enter into an agreement which provides, prior to execution of a project cooperation agreement for the project, 35 percent of preconstruction engineering design (PED) costs;
- (2) Provide, during construction, any additional funds needed to cover the non-federal share of design costs;
- (3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

- (4) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and
- (5) Provide, during construction, any additional costs as necessary to make its total contribution equal to 35 percent of the separable project costs allocated to environmental restoration and 50 percent of the separable project costs allocated to recreation.

b. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate (OMRR&R) the completed project, or functional portion of the project, including mitigation features, at no cost to the Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and any specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

c. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

d. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising during the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs. These documents would be made available for public inspection at reasonable times during normal business hours.

g. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on

lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, and/or maintenance of the project.

i. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project and otherwise perform its obligations in a manner that will not cause liability to arise under CERCLA.

j. Prevent future encroachments on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project.

k. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

m. Provide the non-Federal share of that portion of total cultural resource preservation mitigation and data recovery costs attributable to environmental restoration and recreation that are in excess of one percent of the total amount authorized to be appropriated for environmental restoration and recreation.

n. Not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

o. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms.

Upon conclusion of the public review period for the draft study report, several of the state natural resources agencies submitted written comments indicating their concerns about providing non-Federal funding support for the recommended 65:35 cost sharing program. As a result of those comment letters, senior managers of the Pittsburgh, Huntington and Louisville Districts assessed potential sponsor support for the proposed program. Their evaluation yielded the following conclusions:

a. States support a program with cost sharing that differs from existing law. Recommended plan is in accord with existing law and policy.

b. States support the program as defined by the recommended plan, but not the cost sharing ratio. They support the goals, actively participated in the selection of the potential projects, want to participate, but also want the Corps of Engineers to recognize the states' financial difficulties created by the large local share, in terms of O&M as well as initial investment costs.

c. Recommended Plan would allow for post-authorization development of implementation guidelines, procedures, timeframes and inclusion of the complete spectrum of sponsors, in addition to the state agencies engaged to date.

d. Program Implementation Plan will lay out the process to identify individual sponsors. The Program goals will generate regional, integrated benefits through implementation of individual projects. The individual projects will each develop full project costs that should include the true measure of post-construction costs.

e. Because the program consists of a broad spectrum of separable elements, any initial federal commitment to the overall project is not an irreversible action, and affords opportunity over time for reoccurring project reaffirmations before significant financial expenditures.

As a result of the recommended plan and further rationale provided above, we believe that authorization of the proposed Ohio River Ecosystem Restoration Program is within the overall public interest. We therefore propose that the recommended plan, described in this report, be authorized for implementation with such modifications as the Chief of Engineers may find advisable, and in accordance with existing cost sharing and financial requirements.

The recommendations contained herein reflect the information available at this time. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program, nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for authorization and funding. However, prior to transmittal to the Congress, the program partners, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

11 Oct 00

Date

A handwritten signature in black ink, appearing to read "David R. Ridenour", written over a horizontal line.

DAVID R. RIDENOUR
Colonel, Corps of Engineers
Commander and District Engineer

11 OCTOBER 2000

Date

A handwritten signature in black ink, appearing to read "John D. Rivenburgh", written over a horizontal line.

JOHN D. RIVENBURGH
Colonel, Corps of Engineers
Commander and District Engineer

11 Oct 00

Date

A handwritten signature in black ink, appearing to read "Robert E. Slockbower", written over a horizontal line.

ROBERT E. SLOCKBOWER
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Commander and District Engineer

SECTION 9

LIST OF PREPARERS

The following people were primarily responsible for preparing this DRAFT Decision Document and Environmental Assessment

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Mr. John Furry	M.S, Biology; M.S. Geography	13 years, ecological & social sciences related to NEPA, Huntington Dist; 8 yrs quality assurance of NEPA and Formulation reports, Great Lakes & Ohio River Division	Quality Assurance and Technical advisor

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